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NOTICES—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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A Successful Meeting

THE proceedings at the Annual Meeting of the British Association at Hull quite justified our expectations of discussions of wide interest and of a high standard. The first impression left is one of the thoroughly "live" quality of present-day scientific thinking and its intimate contact with human interests, both intellectual and material. It is, perhaps, too much to claim that the 1922 meeting marks a new era, but it will at least be associated with a genuine striving after progress and a refusal to be content with our heritage from the past. One most hopeful feature, found in widely diverse sections, was the evidence of the new and original work which is going on, by which the discoveries of past workers, instead of being accepted as final goals, are made stepping-stones to higher things. This, of course, is the only spirit in which science can live, and its prevalence promises well for the future. Another notable point was the excellence, in thought and expression, of so many of the contributions. If no single epoch-making theory was propounded there was at least a great body of brilliant and sound thought, and the general effect can only be one of pride at the

collective strength and distinction of the British science school of to-day. To the industrialist, wholly concerned in utilitarian and financial interests, it may sometimes seem as if such discussions are too academic for the practical world of business. It cannot, however, be too strongly insisted that on sound and ever advancing scientific knowledge depends the maintenance of our industrial position. Moreover, it is in the pursuit of pure research that the great discoveries which revolutionise industrial processes are often found. There would be little gain in linking up industry with science unless the resources of science were continually refreshed by new knowledge of what is fundamental, especially in chemistry and physics.

The Chemistry Section was not the least successful. The problems in both pure and applied chemistry selected for discussion were treated with sincerity, and brought out suggestive interchanges and contrasts of ideas. As bearing on industrial and national interests the contributions on "The hydrogenation of oils" and "The nitrogen industry" are reported at considerable length this week, and next week we hope to notice the remainder of the proceedings. The Committee of the Section is to be congratulated this year upon its programme and the manner in which it was able to apportion the papers and discussions as between the essentially practical—for instance, the discussions on hydrogenation of fats and the nitrogen industry—and the more purely scientific. In addition, the presidential address by Principal Irvine was of quite a special character, and the general tenour of the proceedings in Section B, together with what happened in some of the other Sections, in Section G especially, reached a high level. A study of the papers and discussions, however, at once shows that new matter, of varying degrees of importance, represented the bulk of the programme. Where individual papers were presented, and not as part of a general discussion, it must be said that discussion for the most part was lacking in the large majority of cases, owing in part to there being no time available, and also to that characteristic modesty of British Association audiences—in Section B at any rate—to work up a hearty discussion of an informal nature. The attendances on the whole were good, and on the occasion of the discussion on the nitrogen industry crowded, but many who would have been able to contribute usefully on certain points were not present, and it may not untruthfully be said that the industry generally does not appear specially drawn-to British Association meetings.

Next year's meeting has been fixed for September 12 to 19 at Liverpool, under the presidency of Sir Ernest Rutherford, and an invitation has been accepted to meet in Toronto in 1924.

Reparation Dyestuffs Distribution

WE believe it will be found, when the time arrives for a full disclosure of the facts, that much of the criticism of the Board of Trade's new arrangement with the British Dyestuffs Corporation for the distribution of German reparation dyestuffs is based on inaccurate or incomplete information. When the position is fully understood it may still be that those who dislike all restrictions on imports will remain dissatisfied, but the policy for the future of establishing a home and Empire industry is bound to conflict with the older policy of free importation. The first point to be made clear, therefore, is that this country cannot have free trade in dyestuffs and protection for the British dyestuffs industry at the same time, and those who desire to see this country revert to its pre-war dyestuffs policy or want of policy will continue to be dissatisfied with any arrangements based on the alternative policy this country has definitely substituted for it.

As regards the transfer of the Government agency for reparation dyestuffs from the Central Importing Agency—in other words, Fairclough, Dodd and Jones, of Manchester—to the British Dyestuffs Corporation, the position is really simple. These reparation dyestuffs represent the payment of so much of Germany's indebtedness to us. They must be distributed by someone. The merchants, through their organisations, have strongly objected to the old Central Importing Agency on the ground that the firm was not previously in the trade and might begin to compete with the trade. The transfer to the British Dyestuffs Corporation at least assures that the German dyestuffs will be handled by people who understand the business, and probably on terms more favourable both to the Government and to the users. We understand that the Colour Users' Association approve the new arrangement, and that two representatives of the user interest will act in an advisory capacity to the Corporation. Nor, so far as we can learn, is there any ground for the suspicion that the arrangement will give the Corporation unfair preference over other British dyestuff manufacturers; if this point should be raised the Corporation would no doubt welcome interchange of ideas.

Having investigated the position with some care, we believe the new arrangement is consistent with a national policy whose first object is the establishment of a British dyestuffs industry. It is designed to restrict the dyestuffs taken as reparations from Germany to the classes not yet manufactured in this country, and as the German producer gets little or no profit on these reparation dyestuffs, the German dyestuff industry derives no advantage from this trade. Further, it is designed to meet the convenience of users as regards both price and trade facilities and to strengthen the position of home producers by safeguarding the home industry as a whole. Obviously a policy intended to serve these interests cannot serve also the opposite policy of free importation, and criticism from the latter point of view must be accepted as inevitable. A feature of this criticism not to be overlooked is that it is wholly negative and devoid of alternative proposals for securing the ends in view.

A Plea for the Manual Worker

OUR special "Power and Plant" number, published on September 26, included a review by Mr. Alwyne Meade of Mr. G. F. Zimmer's recently published book on "The Mechanical Handling of Materials." Our reviewer made use of the occasion to draw attention to the influence which the development of scientific methods is having upon social conditions and the general intellectual perception of the community as a whole. In brief, his contention was that as we had begun to live in an era in which mechanical ingenuity had triumphed over muscular effort, the rising generation should realise that the workman's sphere of action must gradually be transferred to less laborious but more responsible work. The opinions to which our reviewer gave expression have attracted the attention of several readers who, while recognising that his view is correct in the main, feel that the immediate consequences of substituting mechanical for manual labour are not adequately appreciated. One well-known authority on industrial subjects inquires, for instance, what is to become of the dozen manual workers—that is the "bread winners"—who are displaced, perhaps, by a couple of skilled mechanics? "Is not this," our correspondent asks, "one of the root questions of our industrial system, and is it to be wondered at that the labouring man does not see the fairness of his fate—sacrificed to what Mr. Meade terms the 'elevating effect of machinery'?" Since it will never be feasible to dispense altogether with the manual labourer he will occupy a predominant position. Brawn will command a higher value than brains, and the ultimate state of our mechanical civilisation will be virtual slavery of, or to, indispensable muscular power."

This, of course, is the old problem over again—the temporary displacement of labour by the introduction of labour-saving machinery. We should be the last to disparage the seemingly altruistic motives of those who look with misgiving upon the arrival of an era when machinery or science might tend to eliminate the manual labourer. The main argument, however, in favour of substituting machine for muscle is that the output per human unit is immeasurably increased. Moreover, large-scale production results in cheaper commodities, and cheap goods, again, result in a much greater demand. It will not be disputed that unemployment tends to decrease as the demand for articles and commodities of all kinds increases, so that if mechanical means create a demand they also create employment. Manufacturers may not be philanthropists, but certainly it is a popular fallacy to suppose that they introduce machinery merely to deprive human beings of their work. Ethically, machinery leads to progress, for no one will deny that the brain has always been considered a more valuable asset than mere muscle; but doubtless there must be a transitional period during which a certain amount of hardship will be caused—that is, while the community is adapting itself to the new order of things—and no social reform ever yet occurred without causing temporary dislocation and hardship. It has been said that there is no part of human life which has not been created or transformed by the discoveries and inventions of science. Industry, social organisations, and

international relations have all come under its drastic influence; but vested interests or old-established customs have constantly resisted and rejected creative ideas, so that evolution has been retarded through the ages. In other words, resistance to change is one of the bad habits of human nature; but those who investigate the history of life, with the evolution of ideals and creative activities, find in all these seeming conflicts and struggles no cause whatever for alarm. What is good for the community as a whole must ultimately be good for all its members.

New Chemical Text Books

IN addition to the text-books already announced, Benn Brothers, Ltd. (proprietors of THE CHEMICAL AGE) will begin the issue this autumn of a series of books on dentistry, which is designed to fill some of the gaps at present existing in the literature of the subject. In the first volume, "The Chemistry of Dental Materials," by C. S. Gibson, Professor of Chemistry at Guy's Hospital Medical School, University of London, an account will be given of the chemistry of some of the more important materials used in dental practice. Part I. will contain a description of the dental metals and their chief alloys, and will include an elementary description of the constitution of typical binary alloys. Part II. will consist of chapters on such materials as porcelain, cements, anaesthetics, antiseptics, rubber, and vulcanite. Throughout the book the application of the materials described will be emphasised, and the information will be found useful not only to dental students but also to professional dentists as an introduction to the specialised literature on the subjects dealt with. Later volumes in the same series will be "Human Anatomy for Dental Students," by R. B. Green, M.R.C.S., of the Anatomy Department, University College, London, and "Elements of General Surgery for Dental Students," by W. E. Tanner, M.Sc., F.R.C.S.

Other publications shortly to be issued by the firm will include a new series of full-length monographs, each of which will be devoted to some specialised part of the broad field of gas and fuel. Three volumes will be ready this autumn. Of these the first, *The Administration and Finance of Gas Undertakings*, with special reference to the Gas Regulation Act, 1920, by George Evetts, consulting engineer, will discuss the procedure necessary when applying for special Acts of Parliament, private bills, provisional orders, and so forth. The volume is designed in such a way as to prove useful, not only to technical gas officials but to directors, secretaries, and accountants. In the second of these volumes, *Gasworks Recorders*, the author, Dr. Leonard Levy, in addition to pointing out the almost innumerable uses to which recorders may profitably be put, so describes the construction and practical working of these instruments that those who have to deal with them should have no difficulty in localising and attending to defects on the spot. Almost every form of recorder will be dealt with, and there will be some 200 illustrations.

Finally, *Modern Gasworks Chemistry*, by Geoffrey Weyman, D.Sc., F.I.C., chief chemist to the Newcastle and Gateshead Gas Company, has primarily been writ-

ten so as to form a companion volume to Meade's *Modern Gasworks Practice*, and Hole's *Distribution of Gas*. The last two volumes have for some years provided for the requirements of the gasworks engineer and the distribution engineer respectively, but the equally important chemical phase of the science of gas-making has been very inadequately provided for. Mr. Weyman's volume will include every chemical test and process which is likely to be met with on even the largest gasworks at the present day. There will be numerous illustrations and tables.

Points from Our News Pages

Mr. A. R. Tankard contributes the last of his series of articles on "Chemistry in the Service of the Community" (p. 376). Professor J. W. Hinchley reviews the first five volumes of "The Chemical Engineering Library," published by Benn Brothers, Ltd. (p. 378). Two interesting contributions are published on the problem of solution from "A Spagist" and Professor Findlay (p. 379). The British Association reports include the papers on "The Hydrogenation of Fats," and the opening papers on "The Nitrogen Industry" (p. 380). According to our London Market Report, chemical market conditions continue to improve, particularly in the industrial areas. Our Scottish Market Report describes business as continuing quiet, with prices, however, fairly steady.

Books Received

- REPORT OF THE GOVERNMENT CHEMIST UPON THE WORK OF THE GOVERNMENT LABORATORY for the year ending March 31, 1922. London: H.M. Stationery Office. Pp. 33. 1s. 6d.
 BUREAU OF BIO-TECHNOLOGY. BULLETIN NO. 6. London: Murphy and Son, Ltd. Pp. 36.
 TESTED METHODS OF NON-FERROUS METALLURGICAL ANALYSIS. By Seymour Pile and Reginald Johnston. London: H. F. and G. Witherby. Pp. 127. 7s. 6d.
 ZEITSCHRIFT DES VEREINES DEUTSCHER INGENIEURE. Berlin: Pp. 72.
 INORGANIC CHEMISTRY. By F. S. Kipping and W. H. Perkin. London: W. and R. Chambers, Ltd. Pp. 734. 8s. 6d.
 ORGANIC CHEMISTRY. By W. H. Perkin and F. S. Kipping. London: W. and R. Chambers, Ltd. Pp. 681. 8s. 6d.
 PROBLEMS OF MODERN SCIENCE. By Arthur Dendy. London: George G. Harrap and Co., Ltd. Pp. 237. 10s. 6d.
 ALCOHOL IN COMMERCE AND INDUSTRY. By Charles Simmonds. London: Sir Isaac Pitman and Sons, Ltd. Pp. 119. 3s.

The Calendar

Sept.			
18	Institution of Rubber Industry : "Reclaimed Rubber," Dr. J. Torrey.	Midland Hotel, Manchester.	
18	Chemical Industry Club: Address by Dr. Stephen Miall on "The Club—Some Criticisms and Suggestions." 8 p.m.	2 Whitehall, Court. S.W.1	
18-22	Leeds Chemists' Exhibition. 11 a.m.-8 p.m.	Town Hall, Leeds.	
19-22	Institute of Metals: Autumn Meeting.	Swansea.	
Oct.			
9-15	International Congress on Liquid Fuels.	Paris.	
13	Society of Chemical Industry Annual London Dinner.	Connaught Rooms, Great Queen St., Kingsway, W.C.2.	

Chemistry in the Service of the Community—III.

By Arnold Rowsby-Tankard, F.I.C.

(*Public Analyst and Bacteriologist to the City of Hull*)

This article, which completes the present series, deals with the biological production of glycerin and alcohol, the part chemistry plays in the coal industry, the problem of smoke pollution and the utilisation of atomic energy. The three articles will shortly be republished in booklet form by Benn Brothers, Ltd.

Biological Production of Glycerin and Alcohol

A FURTHER modern development, this time in the domain of bacteriological chemistry, has given unlooked-for results of the highest importance, and by its means many compounds, important in commerce and the industries, may be produced in quantity at ordinary temperatures. It was known to Pasteur as long ago as 1858 that glycerin was a constant product, though only in small amounts, of the fermentation of sugar by yeasts. During the war every possible source of glycerin was exploited, owing to the great importance of this substance for military purposes, and both in Germany and America this familiar fermentation process has been so modified by chemical research as to give a yield of 35-40 per cent. of glycerin. By using cultures of various specific bacteria, other remarkable results have been obtained, such substances as acetone, and butyl alcohol, being produced in considerable amounts. The production of the former substance—acetone—in quantity during the war became of the utmost importance, due to its use in cordite manufacture and in aeroplane varnishes; while the latter substance—butyl alcohol—will, it is expected, be of service in the artificial synthesis of rubber. In all these fermentation reactions, the ferments excreted by the yeasts and bacteria employed act as catalysts, just as do metallic nickel and platinum in the hydrogenation or hardening of oils, and in the oxidation of synthetic ammonia to nitric acid, referred to in the first article of this series.

The biological production of alcohol on a commercial scale by the fermentation of starch from maize, rice and potatoes with the agency of moulds of the *Mucor* species and others is now in operation, but we cannot afford the vast quantities of starch-containing products—most of which are of use as food—which would be required to produce the amount of alcohol necessary for industrial use and progress. The problem of the future is the production of alcohol from cellulose—the chief constituent of wood-pulp; when this is accomplished we shall have enough alcohol to satisfy the requirements of the chemical industries and to use as a motor fuel in addition to or instead of petrol.

The motor industry could never have attained to more than a small fraction of its present dimensions had not the chemist again and again come to its aid with timely discoveries of the highest importance. The refining of crude petroleum, and its separation into lighter and heavier oils of varying uses, are essentially chemical operations, and are carried out under the supervision of skilled chemists. While geologists and engineers have been usefully engaged in tapping new sources of petroleum, and in winning this valuable product from the earth's reservoirs, chemists, urged on by the ever-increasing demand for greater production of motor fuel oil, have shown how certain fractions of petroleum oils of comparatively small value can be split up—"cracked," in the jargon of the industry—to produce more light oils of the petrol type, thus giving a greater yield of the more valuable portions of petroleum. This work has assuredly helped

in great degree the progress of industry and has conserved our natural resources of energy.

The Coal Industry

There remains for consideration one more industry—perhaps, viewed in all its ramifications, the most important of all—the Coal Industry.

Coal is not only one of the most valuable materials used in all our industries—as it is by far the greatest factor in heat-yielding and steam-raising operations—but it is the real raw material of one of the most important groups of industries. This group includes the coal-gas industry; the coal-tar distillation industry; and the coal-tar dye industry, all involving the destructive distillation of coal.

The manufacture of coal-gas, first accomplished over 120 years ago, marked a great advance in the chemistry of illuminants; but as the years passed, and electricity, with all its hygienic advantages, began to compete with coal-gas for lighting purposes, it seemed certain that the latter was doomed to early extinction. A discovery of a German chemist, however, altered the whole position, and gave the older industry a respite from the sentence almost pronounced upon it. The facts prove again, as has frequently happened, that a purely scientific investigation may lead to discoveries of the highest practical import. Bunsen had shown that when coal-gas was burnt with a regulated supply of air, the usual luminous sooty flame of the burning gas was converted into a non-luminous, sootless flame of increased heating-power, and this principle is now in universal use in laboratories, and in our houses is familiar in the gas-fire and in gas-cooking stoves and ovens. When oxygen is used instead of air for mixing with the gas, still higher temperatures can be obtained; and under the influence of the oxy-coal gas blowpipe flame, lime and other substances become brilliantly incandescent—a principle embodied in the well-known limelight lantern for projection purposes. Auer von Welsbach, working in Bunsen's laboratory in 1884 on some oxides of the rare metals, found that certain of these, notably cerium and thorium oxides, emitted an unusual brilliance when rendered incandescent in the Bunsen flame; and he was quick to see the possible value of his observations. Ten years later, the first gas-mantle was patented, and this mantle, when the ramie fibre is burnt away, consists chiefly of a mixture of thorium and cerium oxides in certain proportions. It needs little imagination to picture the enormous industrial importance of this discovery to-day, and it had two immediate results: it materially increased the illumination obtainable from coal-gas, and it allowed of the cheapening of this gas, since luminosity of the burning gas itself was no longer necessary.

The distillation of coal also results in the production of coke, coal-tar and ammonia. In many districts, where the metallurgical industries flourish, special by-product recovery coking-ovens are in use for the making of metallurgical coke; these ovens are heated by the coal-gas made, any surplus being turned into the gas mains, while the valuable tar and ammonia are also recovered.

We have already seen how the ammonia so obtained is the source of much of the sulphate of ammonia used by the farmer as a fertiliser of the soil. But it is in coal-tar—

that veritable magician's box of wonders—that we possess one of the most valuable by-products ever made by man. By careful distillation, an operation which must be constantly controlled by chemists and chemical engineers if the best results are desired, this tar is separated into benzene, used as a motor-spirit and in many other ways; toluene, valuable for making high explosives; phenols and cresols, of great value as disinfectants and insecticides; and from these, and their intermediate products obtained by chemical operations in the factory, are produced a large variety of synthetic medicinal substances, such as saccharin and salicylic acid, and the numerous classes of coal-tar dyes as we know them to-day. The story of the loss of this great industry by our country has often been told, and it is not necessary to repeat it here; the dye industry waned in England, the land of its birth, because of lack of support; and because neither Government nor people realised that between these dyestuffs and the explosives and other materials required in modern warfare, there is a close chemical relationship. Apart from this consideration, the fact that in the event of war, England might see her great textile industries jeopardised, owing to the cutting-off of the necessary supplies of these essential dyestuffs, should have given successive Governments an anxious desire to re-create the dye industry here. But it was not done, and therefore it had to be done at enormous expense during a great upheaval. This herculean task was commendably accomplished in a very short time—and the credit is due to British chemists; for if there is an industry that can be faithfully described as pure chemistry on a large scale, it is the coal-tar dye industry.

Whilst much yet remains to be done, nearly all the most essential textile dyes can be obtained from British firms in considerable quantities. Germany exported to Britain, in 1923, 18,000 tons of dyes; during the two years following the Armistice, over 25,000 tons of dyes made by one British company alone went into consumption in this country, and the total production is now much more. This work was accomplished by chemists; and it is only by efficient chemical control and research that this new-born industry will survive.

Smoke Pollution of the Atmosphere

There is one aspect of the coal question that has been much before the public recently—and this is the pollution of the atmosphere of our industrial towns by smoke, and all that smoke brings with it. The Government Committee on Smoke Abatement has recently issued its final report, and the matter is nearly ripe for settlement, when trade and general conditions become more normal.

In burning raw coal in open grates, we produce and eject into the atmosphere soot and acid sulphur vapours, and in so doing we not only waste the fuel and its heating properties to an estimated extent of 6 per cent., but we do damage to health, to plant life, and to property in the form of buildings and art treasures. Domestic smoke is particularly objectionable, because it is more highly charged with sooty particles and tar than the smoke from factory chimneys. Moreover, we lose in this way all the valuable tar and ammonia obtainable from coal. Town fogs are caused or aggravated by a smoky atmosphere, and the financial loss to the community in extra artificial lighting is frequently considerable. As compared with country areas, industrial towns with a smoky atmosphere lose on the average quite 20 per cent. of the possible sunlight.

The damage done by smoke to vegetation is very large; grass grown in smoky areas is of poor quality, being very fibrous and of inferior value as food for animals. By the tarry soot deposit which falls on the leaves of plants, the delicate stomata are blocked, and respiration becomes ultimately almost impossible. It is a matter of common

knowledge that stone suffers seriously over a period of years in our towns, and euphemistically we term it "weathering." As a fact, however, this damage is largely due to the adherent nature of domestic soot, which by its acid content exerts a corrosive action on the exposed stone surface, more or less according to the nature of the stone. In an industrial town, the atmosphere of which is usually free from the grosser contaminations of smoke, the writer's figures show that during a year there falls on each square mile of the city's surface 444 tons of solid matters from the atmosphere; and of this 218 tons is actual solid matter not in solution, containing 3½ tons of tar. Sometimes the rain collected during a month is acid in reaction in many towns, showing that large quantities of acid sulphur oxide vapours have been ejected into the air.

The seriousness of this pollution is admitted. Pure air is necessary for healthy life, and sunlight is the best natural germicide. What, then, is the remedy for this widespread pollution? In regard to the factory, "smoke" is in most cases unnecessary and should not be permitted. On the domestic side, it is supremely desirable that coal-gas should be cheapened, in order to allow of its daily use in all our houses. The cost of the raw coal is a controlling factor here. A largely increased production of cheap electricity would also be a great advance. But the scientific solution of this problem—assuming that the price of coal-gas and electricity cannot in the near future be very substantially reduced—again lies with the chemist. Already research and recommendation are moving along two main lines in an endeavour to solve the difficulty. In the first place, the production of a smokeless fuel or semi-coke is being worked out. The second line of research is that of improved methods of coal-gas production, and the evolution of a better type of gas fire. For the purpose of supplying a domestic gaseous fuel, it is not necessary to stop gasification at the point when coke, as we now know it, is produced. A great saving could possibly be made if this carbon were also turned into gas, leaving no residue but mineral ashes. By an oxygen method for accomplishing this aim, or in some other way, it is probable that a cheaper gas may be obtainable. But whatever method be finally adopted, if the Government and the community are in earnest on this question, the open coal fire will have to go, and the loss of this cheerful blazing fire must be balanced in our minds against the increased amenities of our towns and industrial areas under the new conditions.

The Utilisation of Atomic Energy

And before the worst comes—before our coal supplies are exhausted—it is safe to prophesy that the chemist, aided by the physicist, will be in the front rank of those scientific investigators who will give the clue to the method whereby the enormous stores of energy locked up in the atom can be utilised. It has been calculated by Sir Oliver Lodge that the atom of helium ejected from the radium atom on its disruption travels at a speed of such an order that while a rifle bullet would travel 300 yards to the target, the helium atom would have crossed the 3,000 miles from London to New York—that is, in one-quarter of a second of time. The output of energy thus represented is 400 times that of the rifle bullet. Moreover, we are not dependent on radium, for we can bombard atoms and to some extent split them up, with ejection of atoms of hydrogen and helium, for example. If we were able to control this atomic energy, and use it to do our work, our power problems would be solved.

This, however, is in the future; but whatever it may hold for us, it is the claim of the chemist that, by evidence of accomplished work, and work of still greater promise, chemical science is of the utmost value to the community.

Benn Brothers' "Chemical Engineering Library"

A Review by Professor J. W. Hinchley

We publish below a review by Professor J. W. Hinchley, A.R.S.M., Wh.Sc., F.I.C., Professor of Chemical Engineering, Imperial College of Science and Technology, South Kensington, of the first five volumes of "The Chemical Engineering Library," published by Benn Brothers, Ltd. It will be seen that the reviewer, in expressing an entirely independent judgment, combines warm appreciation with frank and helpful criticism. The five volumes noticed are published to-day, and may be obtained from the publishers at 8, Bouverie Street, London, E.C.4. They are of uniform crown 8vo size, and are issued at 3s. each.

MESSRS. BENN BROTHERS, LTD., deserve the thanks of all who have the well-being of the chemical industry in this country at heart for their enterprise in issuing this series of books upon chemical engineering. The success of our chemical industry depends upon our progress in chemical engineering, and without it no progress in chemistry nor development of State protection will be of any value to us, but will only help those nations with highly qualified chemical engineers to increase their lead.

Works upon chemical engineering subjects are often disappointing. They are frequently written by unscientific specialists or by chemists who fail to understand that chemical engineering is essentially quantitative, and that pictures and descriptions of chemical plant are poor substitutes for ordered knowledge. These first five volumes are written by chemical engineers, and form excellent text-books for the use of the student and the worker in technical industries.

One may frankly state that the publishers do not achieve their object—"to build up a complete and authoritative reference library dealing with the basic principles of chemical engineering"—if the first five volumes be taken as examples, but they do succeed in a much greater task—in producing books in which our present knowledge of the scientific principles of chemical engineering is presented faithfully, in a simple and readable manner, and at a price which places them within the reach of everyone. The ultimate end will be to raise the standard of education of the whole of the workers in our chemical and allied industries.

One inevitable defect of such small volumes is that they attempt too much. Each of the chapters in nearly all the books might have had a volume to itself.

I.

THE GENERAL PRINCIPLES OF CHEMICAL ENGINEERING DESIGN. By Hugh Griffiths. Pp. 60. 3s.

The author has attempted to compress into about sixty pages all the wisdom of chemical engineering, and he has been remarkably successful. One may disagree with him when he states that "the object of any scientific study is purely economic in the sense that systematic knowledge enables us to transfer experience to a new field with the minimum of mental labour," without objecting to any of his final conclusions. The general problems of the chemical engineer are discussed on broad lines, on the assumption that knowledge is not wanting but that wisdom is desirable, with a view to indicating a method of attack.

The titles of the chapters indicate the scope of the discussion: "The essentials of a successful chemical plant"; "Physical factors"; "Chemical factors"; "Mechanical factors"; "Use of experience and data"; "Practical factors"; "Economic factors"; "The final design." The book is one which will be appreciated by the man of business as well as by students and chemical engineers.

II.

MATERIALS OF CHEMICAL PLANT CONSTRUCTION: NON-METALS. By Hugh Griffiths. Pp. 64. 3s.

This volume is a disappointment as a "work of reference," but excellent as a text-book. The absence of an index is a serious fault. The scope is far too great for one volume, and each chapter should be enlarged considerably for reasonable

treatment. In spite of the compression of such a vast subject the author has managed to present some interesting new knowledge. The chapter on wood (ten pages in all) is particularly interesting, and contains an account of experiments on the action of acids on timbers, inserted by the courtesy of Messrs. Manlove, Alliott & Co., Ltd. It is obviously easy to point to omissions in such a work, but one would expect the "economic factor" to be more in evidence, and more references to sizes of material available might have been given. The book is most readable, thoughtful, and useful, and will prove of great value to the student and factory worker.

III.

THE WEIGHING AND MEASURING OF CHEMICAL SUBSTANCES. By H. L. Malan and A. I. Robinson. Pp. 62. 3s.

The weighing and measuring of materials in a chemical factory has considerable financial bearing upon its success. Economic accuracy and the maintenance of that accuracy and the system of factory account keeping are closely bound together. This little book is concerned only with the general mechanical principles and theoretical considerations applying to works measurement of liquids and solids. The authors deliberately exclude any discussion of the system of weights and measures adopted, although some comment is made upon the keeping of records. The value of one unit only throughout a works is more and more being realised.

Among the different depth gauges described, Mr. Griffiths's electrical depth gauge is explained and illustrated. The Venturi tube, Venturi flume, and weir meters are concisely treated and compared. The chapter on the weighing and measurement of solid materials is compressed so much that qualification of some of the statements might be suggested. The diagrams illustrating the text are very clear, and the table for determining the volume of liquid in a cylindrical tank will prove very useful.

IV.

THE FLOW OF LIQUIDS IN PIPES. By Norman Swindin. Pp. 64. 3s.

In handling the flow of liquids in pipes, the chemical engineer has a problem of greater complexity than that of the water engineer. Little experimental attention has been paid to his needs, so that this little volume will be very welcome to those who wish to obtain and make use of the best knowledge on the subject. The author may be congratulated on presenting a difficult subject in a simple and concise manner. The practical examples which occur at intervals in the text reduce the difficulty of the subject to the smallest dimensions. The personal touch in the author's reference to the "logarithmic gentlemen" does not detract from the interest. The appendix, containing a set of tables giving densities, viscosities, and kinematic viscosities of the most important chemical substances, is a most useful part of the book.

V.

PUMPING IN CHEMICAL WORKS. By Norman Swindin. Pp. 80. 3s.

This volume gives a brief but most readable account of the general principles of designing pumping plants for chemical works. The discussion of the ram pump, with the help of the classical paper of Goodman, forms a very excellent chapter. The centrifugal pump, the acid egg, and the air lift pump are discussed in a simple and effective fashion. Other forms of pumping apparatus are treated in a simple manner, and worked examples in the text are very helpful. The book is a very worthy member of the series.

J. W. HINCHLEY.

The Problem of Solution: Two Suggestive Rejoinders

"Dr. B. Lagueur's" entertaining and suggestive treatment of the problem of solution, in the form of a dialogue between "A Chymist" and "A Friend," which was published in THE CHEMICAL AGE of September 2, has attracted much notice. Two interesting rejoinders are published this week—one from "A Spagirist," a nom de plume disguising a distinguished writer whose opinion is of importance, and the other from Professor Findlay of Aberdeen, whose qualifications need no description. It is worth noting that some of those who twenty years ago were supporters of Ostwald have now modified their attitude, and the views the original article has elicited suggest that the time is ripe for a reconsideration of the hypothesis so long prevalent in this country and universally accepted in America.

Some Reflections by "A Spagirist"

MARRY! but methinks I know the voice of this Chymist who so heartily belaboured his friend and blasphemeth against foreign gods. So was I, in my time, handled for my good, as he protested, by the same sulphuric mentor. But not without retort, for I was ever a favourer of gentil ways in speech, and apt to rebel under contumely.

Yet, in verity must I say, there often lieth in the harsh words of this Chymist somewhat of trewth and eke, it may be, of a trewe philosophy, and it were well at least to consider what he sayeth, however unseemly spoke, and lay it for scrutiny beside what his enemies do affirm on the same matter.

Now in this question of the dissolving of solid boddies in liquid menstrua, I do agree that we have mayhap suffered as much as we have profited from the sect of Ionists, who by their much speaking have well nigh gained, for the little it is worth, a whole world of chymists of the younger and heady sort. The matter seemeth to me thus. When I was yet a young man chymists were mostly set on the vegetable and animal side of our work and were intent on compounding in their laboratories factiously the things which it had pleased the Lord to provide them, had they been content, in the fields and groves of this earthe. The rest of chymists were engrossed in little more than the spagiric art and by the apt use of a master's written word and by charts, to guide themselves, little recking or wotting of its inward meaning, to the making and analysing of composite bodies. Yet here in mineral chymistry, the trewe philosophers, of whom were but few, did trewely know much of what reason lay in their operations and held that they had the better part of the science. They were indeed eke physicists, though they did not chuse so to vaunt themselves, holding to that part of their business as by right an inheritance from their fathers. In this, different indeed were they from the vegetable chymists, to whom physicks was verily physick. When now the Ionists came forth with great shouting and did purport to explain in a very confident way that which, had they but known, was well enow explained before of the analysing art, then did the vegetable chymists, and they of the other sort who were but vulgar manipulators of bottles, proclaim "Here indeed is great trewth and a new and shining philosophy!"

Certes, this new philosophy shewed a fayre form and was simply clad. But when after a season there came to view somewhat of its inward frailty, behold the Ionists bestirred themselves to get succour from those who follow the mathematicks and, succeeding but too well, so enwrapped the sick philosophy with the web and weft of their wondrous garments that the ignorant only stood in the greater amaze that the chymical art should reach so great dignity.

Not but what I would affirm that something hath come of the Ionists' work. Beside some new facts, they gave to many who followed our science but as an empiric art the will to bethink themselves that man, to be worthy the name of philosopher, must ever seek the inward meaning of what he doeth, and perceive, if he can, the law that doth have sway therein to the glory of God.

As for the trewe explication of this dissolving of solid boddies in liquid menstrua I do myself affirm nothing, for I

know nothing that can further enlighten. I hear men talk and I listen, but I depart ever as empty as I came. I venture only on one prophecy: that no great clarity will appear here, nor in many other dark places of our science, till men do take more heed of how the atom is compounded in its parts. An they can find that, they will find how properly to follow in the path of good John Dalton and Michael Faraday.

So agree I in a measure with your scolding Chymist. I will but conclude with this my opinion: that had this same scolding Chymist, with his shrewde mind, but curbed in fayre measure the shrewishnesse of his tongue and set his thoughts more prettily before the world, we should have been mayhap in greatly better case than we are at this time.

A SPAGIRIST.

A Note by Professor Findlay

To the Editor of THE CHEMICAL AGE.

SIR,—I thank you for drawing my attention to the interesting extract from *The Compleat Chymist*, which was published in your issue of September 2. As a humble member of the company of those who have apparently fallen from grace, and who, according to the Chymist, who was baptised Henry, are marching to the scaffold or the lunatic asylum, may I say that I and all others of my companions will gladly flee from the wrath to come if Henry will only show us the way.

We are, of course, all aware of the weaknesses of the simple van't Hoff and Arrhenius theories of solutions; and we know how, sometimes, the cracks which have made their appearance in the superstructure have been filled in, temporarily at least, with somewhat dubious material. But, nevertheless, the structure has stood fairly well in spite of its imperfections, and it is better to have a leaky roof over one's head than no roof at all.

If we discard the ionic theory, on what foundation are we to build? The Chymist offers us a foundation of various polymers of pure water and a quite indefinite and, possibly, indeterminable number of compounds between water and solute. Well, we need not deny that in the process of solution the equilibrium between the different water molecules is altered or that combination takes place between the solute and water. But, if all these changing equilibria are indefinite, how are we to build on such a foundation a system of quantitative relationships between the different properties of solutions? The theories of van't Hoff and of Arrhenius have been valued just because they can be developed so as to represent the quantitative behaviour of solutions, not perfectly, it is true, but still more satisfactorily than any other theory so far suggested. So soon, however, as the Chymist shows how the properties of solutions can be co-ordinated quantitatively in a more satisfactory manner than on the basis of the ionic hypothesis, the latter will be abandoned. Meanwhile, let us take comfort in the concluding words of the Brewer, and at the same time follow the advice of the Chymist to think over the problem, perform experiments, and keep open our mind as well as our eyes.—Yours, etc.

University of Aberdeen.

September 8, 1922.

ALEX. FINDLAY.

The British Association: Annual Meeting at Hull

Papers and Discussions in Chemistry Section

The Annual Meeting of the British Association at Hull concluded on Wednesday. Our report of papers and discussions in the Chemistry Section, a portion of which is published below, will be completed in our next issue.

The Hydrogenation of Fats

DR. E. F. ARMSTRONG's opening paper on this subject was taken out of its turn on Friday, September 8, and the discussion was continued by the other speakers on Monday.

DR. ARMSTRONG, after apologising for having been compelled to ask to be allowed to take his paper out of order, said that the subject of fat hardening was one of very considerable technical interest and importance, and one which presented an almost ideal problem to the student of chemistry and chemical industry, because it brought in every aspect of the chemist's work and every trick of his art. The text-books told them that fat hardening was discovered by Sabatier as part of his epoch-making work on the use of catalytic nickel in the hydrogenation of organic substances, but if they turned to Sabatier's original paper they would find that he clearly stated that he got no reaction whatever when he mixed catalytic nickel and hydrogen with a liquid fat. At about this period a certain Dr. Norman studied the subject, and succeeded in getting results that encouraged him to put his own money and the money of his family into endeavours to work the process out on a large scale. The process, however, was far too difficult to work out with small capital, and ultimately the process in its indefinite stage, and Dr. Norman with it, passed from Teutonic into British hands, and was developed in this country. During the course of his work, Norman imparted some information to a Russian who worked independently, and as a consequence, two sets of Patents occupied the field in the early days, and these passed into the hands of strong financial groups with the inevitable consequence of patent actions and all that that meant. Around the subject there had grown up an enormous literature, and there was a book by Carlton Ellis that contained more inaccurate facts and loose statements than any other work of its size. There were also an enormous number of Patents, very few of which would work. This, by the way, was typical of chemical industry, and it was one of the things they ought to try to alter. How that was to be done, he did not know, but it was practically what happened when any new process was invented and developed, particularly under British auspices. He regarded this as one of the factors which stood in the way of the development of chemical processes in this country.

Hydrogen

The fat hardening process consisted of turning liquid fats into solid fats, or saturated fats, by the addition of the necessary hydrogen. The reaction consisted in mixing fat and hydrogen together in the presence of a catalyst, and this brought the action within the range of so-called catalytic action. The working out of the process of hydrogenation involved three phases: the manufacture of hydrogen, the manufacture of the catalyst in its active state, and the bringing of them together. The manufacture of hydrogen had to be brought under notice in this connection because, before technical fat hardening came into being, hydrogen was only required for balloon purposes and other arts and manufactures in comparatively small quantities, and the progress of the introduction of fat hardening in this country was very much delayed on account of the difficulties met with in the manufacture of hydrogen. These difficulties, however, had been largely overcome, although not entirely. Some of the difficulties were still with us, and if we were to have cheap ammonia we must have cheap hydrogen. He had dwelt on the manufacture of hydrogen because it was typical of many industrial problems. There was the capital cost of the plant, the cost of operation, and the cost of maintenance and repairs. There were a great many processes for the manufacture of hydrogen, but the inventors of hardly any of them ever took all these three factors into account. Most of them forgot one, and some of them forgot two, and nearly all the processes, although ideal in theory, were not economical in practice. It was this which made the manufacturer very suspicious of the inventor and somewhat suspicious of the expert, and although he did

not want to see the university course commercialised, he agreed with what Principal Irvine had said in his presidential address that things must be thought of from the economical point of view. The inventor and the young chemist must realise that a process, although good chemically, if it involved an enormous destruction of plant and a high repair bill, could never be successful, and it was much better not to bring such processes to the notice of their employers.

Mr. Bolton would speak subsequently on the manufacture of hydrogen, and he himself would therefore leave that part of the subject. Perhaps, however, it would be of interest if he said that there were three methods of making hydrogen. There was the electrolytic method, which did not call for attention because its success depended very largely on the outlet for the oxygen which was produced at the same time. There was no difficulty in making pure hydrogen in any quantities if they had cheap power, and he believed it was being produced on the Continent with cheap water power at 2s. 6d. per thousand cubic feet. That was interesting, because very wild figures were being quoted as to the cost of hydrogen. Then there was the catalytic method, which really consisted of breaking up steam into hydrogen and oxygen. The usual method was to do it over iron—to treat clean iron with steam—and the process could be made an alternate one. The iron oxide was treated with reducing gases, such as water gas, which was a mixture of 40 per cent. CO and 40 per cent. H₂, and the iron oxide was reduced to iron, so that by means of that alternation they could turn steam into hydrogen, or starting with water gas they could get hydrogen. The alternative process was the one which was largely favoured by the Badische Co. which had worked out the wonderful nitrogen industry. He would not enter into the relative merits of the alternate and the other process. The process adopted by the Badische Co. was preferable when hydrogen was required in enormous quantities, whilst the ordinary catalytic process was best for small installations.

The Catalyst

Turning to the catalyst, Dr. Armstrong said that nickel had been found most suitable, and technically it was the only possible catalyst that could be employed. The point was to get the nickel into the proper state. After explaining the need for having ample surface in a catalyst and for an absolute clean surface, Dr. Armstrong said that although this sounded very simple, very few people seemed to realise it, and very few of the processes for making catalysts were so described as to enable one to reach that acme of perfection. The practical way of making a catalyst was to take kieselguhr, a natural infusorial earth of extraordinary porosity saturated with a salt. The nickel was precipitated *in situ* in a very thin film through the kieselguhr and reduced under suitable conditions, and the metallic nickel was thus obtained *in situ* on the kieselguhr. In that way it was possible to get the very largest surface of catalyst, but the conditions of reduction and deposition and the choice of the earth all had to be thought of most carefully and most systematically, otherwise the surface would not be anything like so large as was desirable. Care had also to be taken in heating the catalyst, and although reasonably high temperatures had to be employed, the melting point had to be carefully avoided. Further, the impurities in the earth had to be thought of, and the removal of the acid part of the nickel salt had to be carried out with the very greatest care if they were to get an active catalyst. The main point, and a very simple one—although it was very often overlooked in the desire for complexity, which seemed to be fashionable nowadays—was that catalytic activity depended upon having a maximum surface.

The next stage was the bringing of the catalyst, the oil, and the hydrogen together, and bearing in mind the need for care in making the catalyst and the hydrogen, it was obvious that some care must be taken in cleaning the oil. A good deal of mystery had been attached to this part of the process;

long phrases had been used about the products of oxidation and so on, but a simple way to look at the matter was that if they had a fine metal surface and rubbed it with glue the beauty of the surface was destroyed. The albuminous bodies and oxidation products of natural oils, whether from seeds or animal products, would obviously dirty the metal surface of the catalyst; therefore in cleaning the oil they had to consider the elimination of the dirty gummy bodies which would spoil the surface, and the bringing together of the oil, the catalyst and the hydrogen simply involved the necessary apparatus. There were two methods; one being without pressure at an elevated temperature, and the other with pressure and at a still more elevated temperature. A third method was the most perfect, viz., that in which the oil went in at one end and the fat came out at the other, a continuous process.

An Additive Chemical Compound

Having given this brief outline of the technical process, Dr. Armstrong went on to deal with the reaction involved. What had to be explained, he said, was how, in the presence of the nickel, the hydrogen was adsorbed or taken up by the catalyst. There were two schools of thought. The older school believed that the hydrogen was in some way adsorbed at the surface of the nickel and that a magician's wand activated it in some way and it entered into the organic compound. The more modern school, however, looked at the problem somewhat differently, and the view that he himself wanted to put forward was that it was not the hydrogen that came up against the nickel surface, but the organic compound. Remembering what was known about residual affinity, double bonds, and so on, it was quite possible that there was some compound between the nickel and the carbon. Every chemist would admit the possibility of that, and if they went a little further and studied the work done by Lord Rayleigh and later by Hardy and Langmuir, and recollect the theory put forward by the latter as to a layer one molecule thick at the surface of such substances, it was quite possible that there was a layer one molecule thick on the surface of the nickel. His own conception was that of an additive chemical compound at the surface of the nickel which was necessarily one molecule thick.

Professor Bancroft had criticised him and said he was not sufficiently definite in speaking of an additive compound, but if he had time to go into the kinetics of the reaction he might perhaps be able to demonstrate it. If they measured the rate of hydrogenation, i.e., the amount of material hardened in a given period of time, it would be found that in these reactions, dealing with really active catalysts and clean materials and working at an extraordinary rate, equal amounts of substance were changed in equal successive intervals of time. If they tried to be as logical as possible and worked it out they would come to the conclusion that undoubtedly what they were measuring was a change involving either the formation or the destruction of an additive compound. There was no doubt that there was a potential affinity of nickel for fat and a tendency to form an additive compound, a very unstable one, but a real chemical compound, and he took his stand on that point. The results which he had obtained he claimed gave striking experimental proof in support of this theory.

PRINCIPAL IRVINE, in proposing a vote of thanks to Dr. Armstrong, said he thought there was the clearest experimental backing for the theory that had been put forward. The paper was also a plea against the evil tendency to demand that an additive, intermediate, and unstable compound must always be produced and put in a bottle. He hoped that those days were over.

Dr. R. S. MORRELL said he took it that there could be different degrees of hardness of fats, depending very much on the chemical composition of the product. He was particularly interested in the oxidation of oils, and he had found that there were different degrees of hardness of the oxidation product depending on the presence of certain special promoters, some of which were very much better hardeners than others. Was the hydrogenation of fats similar in this respect to the oxidation of oils?

Dr. ARMSTRONG said he would want to know what was meant by hardness. Did Dr. Morrell mean iodine number, melting point, or what?

Dr. MORRELL said he meant physical hardness.

Dr. ARMSTRONG said he did not think that term had any meaning on his side of the industry.

Technical Aspects of Hydrogenation

Mr. E. R. BOLTON (continuing the discussion on Monday) said that the technical application of what would appear to be a simple colloid reaction had inspired something like 300 Patents, all of which had for their object the same end product. He wished he could put forward some sound scheme for the reconstruction of our Patent Law with regard to chemical products, framed in such a way as to frustrate the registration of so many Patents on the one subject without in any way doing injustice to genuine research workers and without producing stagnation of enterprise. Dr. Armstrong had laid so many of the facts before them that he would only now propose to give a sketch of the rapid development of hydrogenation from the laboratory curiosity which it was in 1902 to the commercial revolution of the oil industry in 1910-12 and up to the present day, when processes existed which were responsible for the treatment of thousands of tons of oil per annum.

Hydrogenation had two main objects—first, to produce a hard, solid fat from liquid oil; and, second, to remove certain impurities which were not removable by any other means, and so render the oil of use for purposes for which it could not otherwise be adopted. Passing over the theoretical considerations which had been covered by Dr. Armstrong, Mr. Bolton said the process might be described as the introduction of a comparatively small weight of hydrogen, only a few pounds per ton. This small weight of hydrogen occupied a very considerable volume, approximately 1 c. ft. per pound of oil treated, and it was this comparatively great volume which raised the first difficulty on the commercial side and brought before the manufacturer the necessity for making his first decision—viz., should the operations be conducted conveniently to the supply of hydrogen or to the source of oil? The production of cheap hydrogen had developed into a big industry, and there were various methods of producing hydrogen. In countries like Norway, where there was cheap water power, the electrolytic method held the field at present, and it was only recent improvements in other methods that had led to the hydrogen thus produced, and permitted the process of hardening to be carried out in localities adjacent to the oil supply.

Importance of Pure Oil

What had always received least attention, however, was the oil itself. One read of hydrogen poisons and catalyst poisons, and the extraordinary care in the preparation of products free from these poisons. There were works in which all these precautions were taken as regards the hydrogen and the catalyst, and yet in these same works the catalyst was passed into oil which had received quite inadequate attention, and which was reeking with impurities which could easily be removed. Economy and efficiency in the process of hydrogenation lay in careful attention to the purity of the oil, and he felt that workers had been led astray in the past by the fact that hydrogen purified so effectively. Therefore, it seemed to have been overlooked that most of the impurities, although easily removable by hydrogen, were merely spoilers of hydrogen and wasters of catalysts, if these impurities were left in the oil when treated. Given a chemically pure oil and a chemically pure catalyst, then under these hypothetical conditions the catalyst would maintain its activity for ever, and while such a state of affairs was obviously impossible, it was surely a sound policy to try and approach it as nearly as practicable.

A Suitable Catalyst

With regard to the catalyst, the working of which was often explained but very little understood, nickel was almost universally employed, the exceptions being platinum and palladium, but these could not hope to compete with nickel, in spite of the small quantity necessary, unless it could be shown that their activity at low temperatures and appreciable activity at room temperatures conferred some benefit on the finished product which was not otherwise obtained—for instance, the hardening of particular oils without the destruction of vitamins.

The first stage in the process of hydrogenation was the preparation of a suitable catalyst; the second was the maintenance of its catalytic activity for as long a period as possible; and the third was the recovery and re-activation of the spent catalyst. There were many methods for the preparation of a catalyst, but those most commonly employed were based on the precipitation of nickel carbonate on kieselguhr with subsequent reduction in hydrogen either directly in powder form or actually in the oil itself. Care, however, must be taken in the latter case as there was a tendency for the catalyst to be susceptible to poisons and liable to sudden coagulation. A case had come under his notice where the nickel catalyst had suddenly taken it into its head to get into large lumps like shot and fell to the bottom, leaving comparatively pure oil at the top. This was a colloidal question which he particularly recommended to the colloid chemist, and, incidentally, he thought the colloid chemist had a very large field before him in oils generally.

Notwithstanding all these irregularities, he had seen works in which catalysts prepared on this principle had given excellent results. The simplicity of the dry catalytic method, however, probably accounted for its great popularity. The diversity of results obtained at first were due to lack of temperature control and uneven heating, but the more consistent result now being obtained were due to an appreciation of the effect of low temperature. The position in this respect was that low temperature increased the activity of the catalyst but rendered it more susceptible to poisons; whilst, conversely, high temperature reduced and lowered the activity but increased the life of the catalyst.

Having chosen the method of preparing the catalyst, the maintenance of its activity was important, and there lay one of the great sources of loss or profit in the process. As little impurity as 0·2 per cent. impurity in the oil represented one-fifth of a 1 per cent. catalyst; that was a simple piece of arithmetic which everybody seemed to forget. If the impurity were moisture, fatty acid would be produced and tend to form a coating of metallic soap. If it was any other impurity it would form a film over the catalyst and prevent it from doing its work. The great solicitude, however, paid to the catalyst did not prevent it from ageing, and the question of recovery and re-activation arose in time.

The fact that hydrogenation was profitable in the early days was due to the fact that residues containing 1 part of nickel, 1 part of kieselguhr and 2 parts of oil were discarded; the proportion of oil was subsequently somewhat reduced, but ere long the recovery of nickel became essential to economical working. Processes had been suggested in which the oil and nickel could be recovered from residues in a condition for immediate use, and such processes would, no doubt, come into general use in the future. The successful operation of such processes really meant that the catalyst became a capital charge, and such a revolutionary change was likely to lead to a complete alteration in the whole procedure of hydrogenation. It was possible to imagine that when one put down a plant one paid so much for catalyst and it was charged up to capital and there would be no need to charge any more up to capital, all the time. It made the process very much cheaper, and it was likely to come.

Great engineering skill had been displayed in the designing of all kinds of mechanical devices for violent agitation and intimate admixture, but the advancement of the art was in no way commensurate with the skill and energy expended. In his opinion, to use an American expression, "engineers have been barking up the wrong tree," and had aimed at violent agitation entirely, whereas to the simple-minded, who had not been led into the mystic paths of theory, it was obvious that the hydrogen must be in solution in the oil. Useful results had been obtained with a gentle circulation of the hydrogen, a saturated oil.

Types of Plant

The main types of plant were: (1) a vessel full of oil containing a catalyst in suspension to which hydrogen was circulated by mechanical means, possibly also assisted by plant to maintain the suspension of the catalyst; (2) a vessel full of hydrogen into which an intimate mixture of oil and catalyst is introduced; and (3) a vessel containing a catalyst and in which oil and hydrogen are circulated. Unfortunately, sometimes the aim has been to secure a patent at any cost rather

than to effect a real improvement in the process. After all these elaborate devices, it seemed ridiculous to think of a simple method which he used in his own laboratory for testing samples of oil for suitability for hydrogenation, but which gave the result just as well. He took some activated nickel wool and pushed it into a test tube and filled it with oil, put it into an oil bath, left the hydrogen tube in, and called again back when it was ready. It was then possible to pull the hardened fat out of the test tube with the wool inside. He had been able to prove that this laboratory method could be extended with simplicity to the works scale.

It had been suggested that the poisoning of a catalyst was in proportion to the mass of the catalyst, while hydrogenation was a function of the surface only, and this suggestion had received experimental support from the work of Maxted. Therefore, a catalyst of relatively large mass in proportion to its surface would be expected to hydrogenate oils containing small quantities of poison, independently of these poisons. He had obtained some results with his simple nickel wool method, which gave some support to these views.

In conclusion, Mr. Bolton said it was pleasing to think of the idea of a continuous process, of a fixed catalyst capable of revivification *in situ*, delivering oil without appreciable loss, and as an added refinement, the possibility of setting an indicator to deliver automatically a continuous stream of oil of the precise degree of hydrogenation required, and with mechanical conditions of control, so that the conditions could be altered to suit the particular process. That might sound rather ahead of the times, but he did not think it was by any means out of sight, and he did, as a matter of fact, know that plans were already on paper for that sort of thing; whether they would work or not, the proof of the pudding was in the eating.

The PRESIDENT said they were very much indebted to Mr. Bolton for his contribution, and particularly for the revelation he had given as to his ideals. Mr. Bolton saw in the future hydrogenation working almost automatically with a catalyst efficiency of 100. Mr. Bolton also saw hydrogenated fat retaining vitamins unimpaired in efficiency, and in the end he saw a continuous process at work, the director of which would have nothing to do but sign cheques for his salary. That was the right spirit for the chemist to work in. (Laughter.)

Discussion

Professor J. W. MCBAIN said that, as they all knew, very little had been done in colloid chemistry of non-aqueous solutions. The whole conception of colloid chemistry, as far as physical chemists were concerned, had been built up almost exclusively on aqueous solutions, and everything was covered with ions, but these conceptions were valueless when it came to dealing with a system where the solvent was oil, and where there were no ions. That part of colloid chemistry was crying out for treatment, and he believed that in a few years we were bound to see a new branch of colloid chemistry.

Dr. LUSH said he visited a small factory the other day and could confirm what had been said by Mr. Bolton as to the catalyst often being used as a means of purifying the oil, which was not the ideal way of working. When he saw this plant working, he was told that it was rather complicated in design, but that it hardened oil in 15 minutes, which was very satisfactory. When he expressed surprise that it should be necessary to work so quickly, and with such an expensive plant, he was told that in the opinion of the man working the plant it was a race between the catalyst becoming inactive and getting the work done in time. If they did not get it done quickly they would not get it done at all. In other words, they were using the catalyst as a means of removing the impurities in the oil. It was a costly proceeding, as it cost about £2 to produce enough catalyst to harden one ton of oil in these particular works.

Mr. A. R. TANKARD (Hull city analyst) said that those interested in food chemistry were concerned as to whether the hydrogenation of fats introduced small quantities of nickel or other metallic substances in the finished product which might possibly be used for edible purposes. For some time after the process of hydrogenation was introduced commercially, it was possible to detect, in hardened fats, quite appreciable traces of nickel. For a long time, however, it had been his experience that he had not been able to detect nickel in appreciable quantities, and he would like to know whether

it did not now exist or whether there were still antiquated processes at work which might still give edible fats containing nickel in appreciable quantities.

Mr. BOLTON said the presence of nickel in edible fats was rather an old bogey. In the early stages of hydrogenation it was said that edible fats produced in that way could not be eaten because they contained nickel, but an enterprising German consumed a certain quantity a day for a long period and was still well, unless he had been killed in the war. In the usual processes to-day, however, the quantity of nickel was such that it could not be detected by an apparatus capable of detecting one part in ten million.

Study of Soap Solutions

In a paper on this subject, Professor J. W. McBAIN said that the chief interest in the study of soap solutions lies in the light which is being thrown on the subject of colloid chemistry. Incidentally, information is gradually being accumulated and published which should enable the soap manufacturer to obtain equally good or better products much more directly, quickly and economically. We were, he said, only at the beginning of the study of this immense subject, since we were trying to obtain our main results by several independent methods before accepting them, but already some useful quantitative methods had been developed, and some conclusions of general interest might be drawn. There seemed every reason to believe that soaps are a prototype of a very large class of substances, many of which are of industrial importance. The soaps particularly lent themselves to study on account of their great variety and their known and simple chemical formulae. He exhibited a number of charts to show the constituents that had been found to exist in these soap solutions. Hydrolysis or the hydroxyl ion was, for many purposes, of negligible importance, since a free acid such as cetyl sulphonic acid showed the same typical behaviour. Leaving aside any more detailed account of what had been done in the past, Professor McBain said he would divide his remarks into two portions, dealing with solutions and jellies respectively.

The latest method which Mr. Jenkins and himself had applied to the study of soap solutions was that of ultra-filtration, and although the charts were drawn up as a result of quite different methods, such as conductivity and freezing point, they provided quantitative confirmation in the results of ultra-filtration. When we said, from conductivity and osmotic data, that a solution was colloidal, it was found that

the solution would not pass through a dense membrane although all the crystalloidal matter did. This seemed to him and his collaborators clear proof of the correctness of the aggregation theory of colloids; that is, the unit of colloidal matter is not the molecule but a much larger aggregate. This conclusion seemed to follow unavoidably from the results of ultra-filtration. For instance, the particles of undissociated colloidal sodium oleate were larger than $75\mu\mu$; that is, they must contain hundreds of molecules. This experimental result was of general importance, since most of the workers in protein chemistry now tend to regard the very closely allied protein salts as consisting of simple molecules in true solution, and almost deny the existence of a colloidal state.

The most interesting constituent of soap solutions was probably the ionic micelle. This again was shown by ultra-filtration to be an aggregate of about ten simple fatty ions, since it was just held back by pores of corresponding size. The ionic micelle thus behaved like a colloid in being an aggregate, in the high velocity that it imparted to the solution, and in exhibiting a very low osmotic pressure. Its equivalent conductivity, however, was extremely high since the conductivity was three to four times the sum total of all the ions which had gone to make up the aggregate.

Colloidal and Crystalloidal Solutions

Hydration was another topic that had played a prominent part in the discussion of both colloidal and crystalloidal solutions. It had been freely postulated and as freely denied. Arrhenius, for instance, scouted the possibility of the high degree of hydration frequently assumed for substances or particles in solution. We had now, however, what appeared to him to be direct and conclusive proof of its reality. When a soap solution containing some simple reference substance such as potassium chloride or glycerine was filtered through a membrane which was dense enough to hold back the colloidal soap, the concentration of the glycerine or potassium chloride was much greater in the filtrate than in the original solution. Was any other explanation conceivable than that some of the water was held back in combination with the soap? The hydration found by this new general method worked out at the high value of a dozen or two molecules of water to one of soap. In passing, it should be remarked that there is now a fair amount of evidence against the idea that soap solutions are emulsions or emulsoids, and the same conclusion could be extended to the gelatine and the proteins.

Miss Laing's investigation of soap solutions in the form of transparent elastic jellies had already done a great deal to clear up the subject of the structure of jellies.

Discussion on the

Dr. Harker's Review

On Tuesday the Chemistry Section was occupied with a discussion on "The Nitrogen Industry." The first paper was contributed by Dr. J. A. Harker, F.R.S., on "Post-War Progress in the Fixation of Nitrogen."

DR. HARKER said that since the institution of the submarine campaign six or seven years ago, the nitrogen problem has been much to the fore. Not only in scientific and technical literature, but in the daily and popular press. Only recently he had seen a question on the subject in a schoolboy's examination paper, from which it was evident that he was expected to have some real acquaintance with the more important modern processes. Dr. Harker feared that if that examination had taken place six years ago, and if the candidates, instead of being schoolboys had been some of those officials to whose lot it fell during the war to take great decisions on questions of fundamental national importance, the examiners would have had some vigorous things to say as to the quality of the answers. They would have remarked that, although the candidates might have all of them be distinguished, their distinction did not arise from any superfluity of knowledge of nitrogen, whether for explosives or fertilisers.

To a much greater extent than was often the case, the technical literature of nitrogen originated from prejudiced sources. A writer describing one of the fixation processes, or contrasting one process with another, set about his task with such a mass of fixed prejudice that these affected his whole outlook. For example, an enthusiast on the synthetic

Nitrogen Industry

of World Conditions

ammonia process was so biased that under no conceivable circumstances would he admit that any good thing could ever come out of cyanamide. Consequently, what he wrote about it had possibly to be regarded as something to be placed in the same category as, say, an essay by a Jewish author on the utility of bacon as a foodstuff. In the course of a discussion which he had with a chemical engineer from Poland a few weeks ago on the Report of the Nitrogen Products Committee, he asked his companion how he first heard of the Report. He answered that his attention had been called to it by the managing director of a firm of constructors of chemical plant in Berlin, who had told him that in his view it constituted the only presentation hitherto made of the nitrogen problem in its various aspects in which the different processes were examined impartially and in detail, and their advantages and disadvantages set forth without prejudice by a competent judicial authority. The author's own attitude towards the Germans at the moment was to care little for their views, and to endeavour so to regulate his conduct as if Germany did not exist, yet he considered it worth while to mention this unexpected testimony to the usefulness of the labours of the Committee.

Dr. Harker then gave a bird's-eye view of the present state of nitrogen fixation, and discussed briefly some of the more important new developments. He was not at liberty to speak of them all, and pointed out that absence of data about any particular process or development should not be taken to imply that progress was not being made.

The Arc Process

Dealing first with the arc process, the oldest method of obtaining fixed nitrogen from the air, which consists of burning air by passing it quickly through an intensely hot electric flame, Dr. Harker said that in the best known type of furnace—the Birkeland-Eyde—this flame was a powerful arc spread out by a magnetic field into a sort of catherine wheel, several yards in diameter. A small percentage of the nitrogen and oxygen of the air, traversing the path of the arc, was caused to combine, and the resulting nitric oxide was ultimately further oxidised to nitric acid or nitrates. The process was put into commercial operation in Norway in 1904, and in the hands of the original company it had been uniformly successful, having reached an enormous development. Although the power requirements of the process were very large, it nevertheless afforded the cheapest known method for the manufacture of nitric acid. It had not been sufficiently recognised that the arc process in its industrial form owed its initiation in a very great measure to scientific researches carried out mainly by British investigators. When, during the war, he was privileged to see the whole of the developments at Notodden, and the larger and newer plants at Rjukan, officials of the Norok Hydro Co. told him that Professor Birkeland recognised frankly that his inspiration to found an industrial process was derived from the famous British Association address of Sir William Crookes, and especially from the quantitative experimental work of Lord Rayleigh. Lord Rayleigh's big flask, mounted on a wooden stool, and provided with a pair of metal poles and an internal potash fountain, which was still at the Royal Institution, was the lineal ancestor of all the great Norwegian plants of to-day. His experiments, employing one or two horse-power in this apparatus, in which he carefully measures for the first time the relation between the energy consumed and the amount of nitrogen fixed, pointed the road to all that has since happened in Norway.

At Notodden plant was now installed to utilise about 45,000 kilowatts, and in the two great works at Djukan, Dr. Harker saw furnaces in operation employing in all over 200,000 kw. or 270,000 continuous horse-power, this energy being generated at what was almost certainly the cheapest hydro-electric plant in the world. At Rjukan II a 15,000 kw. steam-operated set had now been added to utilise waste steam raised in the boilers employed in the cooling of the process gases, which left the furnaces at about 1,000 deg. During the latter part of the war period almost the whole output of these enormous works came to France and England for munition purposes.

Though the arc process had now reached the stage of a magnificent engineering achievement, it was somewhat startling to remember that less than 2 per cent. of the electrical or heat energy expended in the average arc furnace was absorbed as chemical energy in the initial oxidation of the nitrogen. The concentration of nitric oxide in the gases leaving the furnace averaged only about 1·2 per cent., and, therefore, it was not surprising that many suggestions had been made for the improvement of the efficiency of the process, and all kinds of alternative forms of furnace plant had been proposed. Some of these had been tried during the war, and about 14 arc plants of various types, mostly of small output, were now distributed throughout the world. Among these, the author mentioned an experimental plant of about 300 kw. capacity, which was erected at a munition works at Birmingham on the Kilburn-Scott system.

One of the more important variants of the original process depended on the use of enriched air instead of common air. This had been used on a considerable scale by a company operating works in Switzerland and Germany. The oxygen content of the air utilised was increased to 50 per cent., and to prevent loss of oxygen the whole operation was carried out in a closed circuit. The product, instead of being absorbed in towers, was generally removed by cooling, as liquid nitrogen peroxide. Although under certain conditions the increase in yield of fixed nitrogen obtained from the enriched gas was considerable, and although many tons of liquid NO_2 were made by the process, certain serious difficulties were encountered, and several explosions had recently occurred in these plants. The nitric acid works on the Birkeland-Eyde system erected during the war in France were now closed, it having been found necessary for the power employed to revert to its original purpose—railway electrification.

Synthetic Ammonia Process

Dealing next with the synthetic ammonia process, originally worked out by Haber and his colleagues, Dr. Harker said that this process was translated into a technical success by the Badische Co., and was now employed on a huge scale at their original works at Oppau on the Rhine, and at the much larger works only recently completed at Merseburg, in Saxony. But to-day this was by no means the only process for the manufacture of ammonia from its elements. There were now quite a number of other synthetic ammonia processes distributed over the leading countries of the world. Indeed, one might almost say that a country that appeared to have no ideas in this direction was in some danger of becoming what the Americans would call a back number. The original German process operated at 200 atmospheres, now considered only a moderate pressure. In order to secure autothermic working, very large units were employed, and the gas velocity was kept low, the reaction vessels being enormous flanged tubes of steel nearly 40 ft. long and over 3 ft. external diameter, with walls 6 in. thick. The gases were preheated before being passed over the catalyst, and were re-circulated through the system, after removal of the ammonia they contained.

In the process worked out independently during the war at the research laboratory of the Nitrogen Products Committee at University College, much higher gas velocities were employed. It was found that the yield of ammonia under these conditions from a given quantity of good catalyst materials could be enormously increased, and in the technical plant which was designed it was planned to obtain about 5 kg. of ammonia per hour for each litre of space filled with catalyst, instead of about 400 gms. as in the original German system. In the plant to produce 11,000 tons of nitrogen annually in the form of ammonium nitrate, erected at Sheffield, Alabama, by the U.S.A. Government, from the designs of the General Chemical Co., in 1917-18, and working on lines not greatly different from the German process, activated sodamide was used as catalyst material. This was difficult to prepare in bulk, and its activity, though at first fairly high, was permanently destroyed even by small quantities of water vapour. Therefore, it was not surprising that this plant did not reach the stage of commercial operation. But, profiting by the lessons of this comparative failure, an American company, formed by the General Chemical Co. and the Solvay Process Co., had erected near New York an improved plant on lines not dissimilar to those followed at Sheffield. This had been producing liquid ammonia for the refrigerator industry for over a year at the rate of ten tons per day.

The Claude Process

The Claude process differed mainly from the Haber process in that under the very high working pressure adopted about 900 atms., the percentage combination attained in the gases after a single passage was about 40, instead of 10-11, giving about 25 per cent. of ammonia in the issuing stream. The yield of ammonia per litre of catalyst per hour in technical operation reached the high value of about 5 kg. Multiple stage working was adopted instead of re-circulation of the gas, and the dimensions of a full size unit plant giving a technical output of 5 tons per day appeared almost absurdly small in comparison with the monumental structures employed in the German process. When Dr. Harker was at Montereau, where the factory is situated, M. Claude showed him at work his latest form of catalyst tube, made by a well-known firm of steel makers in Sheffield (England), of a new material having very remarkable properties at high temperatures. These tubes were standing up extremely well to the trying conditions, and promised to give a safe industrial life much longer than anything previously attained. In the Badische process the cost of preparation and purification of the hydrogen used amounted to from 65 to 70 per cent. of that of the ammonia produced. It was, therefore, evident that hydrogen production was of paramount importance, and it was to the preparation of cheap hydrogen by a new process from the gases of the coke ovens at Bethune that Claude was at present devoting his attention.

The Casale Process

In the Casale process, as now running in Italy, the hydrogen was obtained electrolytically from large cells of a new type operated from hydro-electric current obtained from the great

waterfalls near by. Some of this hydrogen was burnt with air, and thereby the required mixture of hydrogen and nitrogen was produced. Much attention was now being given to the question of the bulk generation of electrolytic hydrogen. Several new types of cell of large capacity had been worked out by boy inventors in this country, and in Switzerland, Italy and America. A number of proposals were on foot for the use in different parts of the world of electrolytic plants on a very large scale for the production of hydrogen for the manufacture of synthetic ammonia. There was good reason to believe that under the present conditions, and the very much higher price of coke now prevailing, hydrogen produced in bulk at a favourable site from cheap hydro-electric power would easily be able to compete with that obtained by other methods. To ensure this, however, the type of cell employed required to be much cheaper, in order to keep down the capital cost of the electrolytic plant, which otherwise would be almost prohibitively large.

The Cyanamide Process

This, though stated by many authorities to be obsolete, had at the end of the war an aggregate capacity in tons of nitrogen distinctly greater than that of any other fixation method. It was quite true that since the Armistice many of the works erected or enlarged during the war period had been closed : in some cases their situation was unfavourable for post-war commercial operation, and some of them, whose output was used as a source of ammonia for munition purposes, were unable, under present costs of labour and raw materials, to operate for the commercial manufacture of fertiliser. The largest cyanamide works in the world, capable of producing about 200,000 tons annually, erected by the American Government in 1918 at Muscle Shoals, in Alabama, was one of these. The Americans spent money like water when they entered the war. Their nitrogen programme, including the expenditure on unfinished plant scrapped at the time of the Armistice, cost no less than 140,000,000 dollars. Muscle Shoals alone, exclusive of the hydro-electric scheme now being proceeded with, cost nearly twice as much as Gretna, and it was still uncertain whether the Government would lease it to private interests, or keep it, and the synthetic plant at Sheffield, wrapped in cotton wool ready for the next war. When Dr. Harker was in America a while ago, nitrogen was a very live topic, on which almost everyone had strong views. To be a good democrat in the South, one had perforce to be a supporter of the Muscle Shoals development, whilst to a follower of President Harding it was almost an article of political faith to be anti-cyanamide and to oppose the expenditure of further money on the power project and the completion of the Wilson dam.

So far as Dr. Harker had gathered, there had been no new development of outstanding importance in the manufacture of cyanamide itself, although detailed improvements had been made ; nevertheless, even under the present difficult conditions cyanamide was still almost certainly the cheapest form of combined nitrogen. In Germany, notwithstanding the recent big synthetic ammonia developments, plans were now on foot for an immediate approximate doubling of the capacity of the great cyanamide plants of Frank and Caro at Priestortitz. Though the nation could not pay its just debts, there appeared to be still plenty of money for private enterprise. But cyanamide, when made, was at best an unsatisfactory fertiliser for many soils. Some weeks ago the author had an analysis made of what was probably a rather old sample of cyanamide, and to his surprise he found that the nitrogen it contained had practically all changed over to the form of dicyandiamide. If that transformation often went on to anything like the extent he had noticed, it was no wonder that the action of cyanamide in the soil was sometimes injurious rather than beneficial. Many efforts had been made during the last few years to find some process by which cyanamide nitrogen could be transformed cheaply into some other compound : to transform it to ammonium sulphate was a relatively expensive process. Until lately, the researches to this end had met with small success. An American company was now manufacturing form cyanamide for export a concentrated mixed fertiliser in the form of mono-ammonium phosphate, sold under the trade name of "Ammophos." This would appear to be a promising material, but was too costly for many applications. Within the last year independent investigators working along parallel lines in Sweden and Switzerland had succeeded in perfecting

processes whereby, by the action of carbonic acid, free cyanamide was first prepared from a solution of calcium cyanamide, this being transformed subsequently to urea. In the Swiss form of the process excess of the sulphuric acid employed in the second stage of the transformation was afterwards used to act upon phosphate rock, which was changed to monocalcium phosphate. The final product was a neutral body known in France and Switzerland as "Phosphazote," having its nitrogen content as urea, and its phosphorus in the water soluble form. Dr. Harker was informed that the cost of manufacture was not high, and that, unlike cyanamide, the substance had no deleterious action on the skin or on the bags in which it was packed. It had been manufactured in Switzerland on a fair scale for six months, the product going mostly to France for vine culture. The relation of the two constituents could be varied within limits, but the usual form in which the fertiliser was sent out contained 11 to 12 per cent. of urea nitrogen, and 11 to 12 per cent. available P_2O_5 . These two new processes, which apparently were in course of rapid development, might prove to be a means of rehabilitating cyanamide as a product of fixation, and might shortly assume a position of importance.

The Cyanide Process

The cyanide process, by far the oldest practical fixation method, still attracted many investigators. A British company was continuing its experiments at Birmingham, and in America cyanide was being made on a considerable scale from cyanamide as a source of hydrocyanic acid for purposes of plant fumigation. In the opinion of some American experts, the costs of cyanide production by existing methods were excessive, and the cyanide process was not likely to be competitive until further research was carried out on the fundamental reaction involved in the preparation of sodium cyanide. Investigations in this connection were being undertaken by the Fixed Nitrogen Research Laboratory of the American Government.

A Final Warning

In conclusion, Dr. Harker uttered a solemn word of warning. He is by temperament no alarmist, but he felt it his duty to call public attention to one or two important facts. In 1913 Germany consumed about 200,000 tons of nitrogen, of which about 110,000 tons was imported in the form of Chili nitrate. The bulk of this consumption was used in agriculture. Professor Matignon, of the College de France, stated that from May 1, 1921, to April 30 of this year, the smaller Germany of to-day consumed 290,000 tons, 45 per cent. more than in 1913, without the demands of her agriculturists being entirely met. Furthermore, the whole of this increased total was produced within the country from the German fixation and by-product industries. That was not the whole story. The limit of capacity of production of the German works was far from being attained in 1921. Though the German Government pleaded bankruptcy, the Badische Co. appeared to have had little difficulty in finding money to repair the enormous damage caused by the great explosion at Oppau last September. The works were now on the point of being ready to produce their full rated output. At the end of this year Germany would have at her disposal an internal capacity for the production of fixed nitrogen of about 500,000 tons annually, which would render her entirely independent of all importation. In the case of another war she would be assured of the basic materials for a gigantic production of munitions, together with enough fertiliser to enable her to grow a very large share of her own food. It might be justifiable for the Allies to allow our late enemies to put themselves, so soon after the war, into so strong a position, but, on the other hand, it may be that those whose function it was to see that *some* of the provisions of the Peace Treaty were carried out were unaware of what was now happening. Let them beware that, whilst Gretna and almost all our own munition works were calmly being dismantled, the world was not caught napping a second time.

Papers were also read by Mr. J. H. West ("Raw Materials for synthetic ammonia : the manufacture of hydrogen and nitrogen"), Mr. C. J. Goodwin ("The Häusser Process of nitrogen fixation"), and Dr. E. B. Maxted ("Some aspects of the relation between water power and nitrogen fixation"). Reports of these as well as of other proceedings will be published next week.

Scientific Research in Industry

Department's Annual Report.

FROM the annual report of the Advisory Council for Scientific and Industrial Research on its work for the year 1921-22, it appears that the Council have been seriously concerned with the efforts of the Treasury to cut down expenditure, and after reducing estimates by 34 per cent. they reported that any further sacrifice would not be a measure of national economy. They insist that their work has not been war work.

"The problem before the country, as we see it," says the report, "is to provide a means which will enable its population of nearly 50,000,000 to live and prosper. It is well recognised that for four-fifths of their food and for a great part of the necessary raw and semi-manufactured materials for industry, the people of these islands are dependent on supplies from overseas. These supplies can only be obtained if this country is able to carry on its exporting industries in future with greater efficiency than the rest of the world. We consider that scientific and industrial research, along the lines which we have laid down and on which we have been building during the past seven years, is an essential factor in the national effort on which the continued maintenance of our present population unquestionably depends."

Does the Work Pay?

During the year a number of reports were issued dealing with particular departments of research, but the Council, as justification for expenditure already incurred, give some illustrations of actual achievement. "What does the country get for its expenditure of some £500,000 a year?" they ask. Such a question is particularly difficult to answer because the results of research are often long delayed, and when they come they are often indirect and therefore incapable of being brought into monetary relation with the original expenditure. None the less, some indication can be given of the value of our work in terms of immediate benefit. The inquiries and investigations of the Fuel Research Board have opened up to the gas industry the possibilities of higher efficiency in the use of coal for the production of gas, which will not only conserve to an important degree the coal resources of the nation, but will also lead to annual savings to the consumer out of all proportion to the entire annual cost of the department. With extended practice the saving would be largely increased. The routine work of the national Froude tank is saving shipbuilders who consult it from 2 per cent. to 10 per cent. of their coal bills; its investigations for the Admiralty and the Air Ministry cannot be evaluated in terms of money.

"But it is not merely by the conduct of research that the Department is adding to the national wealth or saving the pocket of the taxpayer. Through its expert boards and committees it is often able to prevent expenditure which scientific considerations show to be unnecessary. It is obviously impossible to publish details of this kind, but we know of one case in which a department of State was persuaded to abandon a scheme for the erection of a large station at the cost of some millions by the information it received from one of our boards."

One of the means taken to assist research is to help research associations, and twenty-two of these are in active operation. They were to be assisted for a period of five years from the fund of £1,000,000 set aside for the purpose by the Government. The Council are certain that results will come from research by those associations into the problems of particular industries sooner or later, and they urge industries not to give up, but to regard the cost as in the same category as insurance. Instances are given of some of the actual savings already secured. The British Portland Cement Research Association was one of the first to be assisted, and as a result of its work one works reports a saving in fuel to the value of over £25,000 a year. Another works reports a saving of from 300 to 400 tons of coal a year, with an increased output. The Linen Industry Research Association has produced a strain of seed which gives a yield of fibre per acre in excess of anything at present being produced.

"Pure" and "Industrial" Research

The council points out that there is a misconception in the distinction between "industrial" and "pure" research. They emphasise the essential unity of all genuine research, and quote an example of the work of the Food Investigation Board. When difficulties were encountered by shippers and firms

engaged in the cold-storage industry, the Board insisted on the necessity for research into the fundamental physiology of living and dead foodstuffs as antecedent to an attack upon particular and obvious difficulties. The sequel is as follows:

"The attention of the Board was recently called to three cargoes of apples from Australia which had suffered loss by what is technically described as 'brown-heart,' amounting in one case to between £30,000 and £50,000. The research already done by the Board into the life-history of the apple after gathering enabled it to prove, directly the atmosphere in the holds of the vessels had been tested, that the apples had been 'suffocated' by the carbonic acid gas they had themselves produced during the voyage. Yet a previous report upon this mysterious 'disease,' made without a knowledge of the Board's investigations, attributed the damage entirely to insect injury in the orchards! The Board had no foreknowledge of this particular 'disease' and had not been looking for its diagnosis or cure, but the new scientific knowledge of the living apple, obtained under the stimulus of necessity, not only made an immediate diagnosis possible, but enabled the Board to prescribe a suitable treatment of future cargoes of apples which would make a recurrence of 'brown-heart' impossible."

The French Potash Industry

ACCORDING to the *Journe Industrielle* of August 30, forwarded to the Department of Overseas Trade by the Commercial Secretary at Paris, the output of potash in France during the second quarter of this year showed an improvement on that for the first quarter, the respective figures in tons of pure potash (K_2O) being 46,282 and 38,733. The following table shows the output in tons of the various salts during the period under review:

	April.	May.	June.
Crude salts (12 to 16 per cent. K_2O)	22,395	23,866	20,323
Fertilising salts (20 to 22 per cent. K_2O)	19,575	22,513	33,860
Fertilising salts (30 to 40 per cent. K_2O)	734	404	1,949
Chloride (more than 50 per cent. K_2O)	10,864	14,213	11,174
Total (in K_2O)	14,149	15,671	16,462

Export returns confirm this favourable impression. There has been a slight decline in exports of nitrates of potash but a considerable increase in exports of double sulphates of potash and magnesia, carbonate of potash and salts with a high tenor of K_2O , such as carnallite, sylvinitite, and similar products. There has, however, been a marked decrease in sales of chloride of potash, exports to Germany, in particular, showing a considerable fall.

The following table shows in metric cwt. the quantities imported from France by the principal countries during the first half of the year:

	Carnallite, Double sulphate sylvinitite, of potash and chloride.	Carbonate magnesia.
England	29,448	—
Germany	348,260	—
Holland	93,970	—
Switzerland	24,160	57,407
United States	—	203,836
Belgium	1,263,076	71,509
		664

New York Newspaper Conference

THE first of the delegates from British Publishing Houses to sail for the United States to attend an important international newspaper conference in New York, on October 11, 12 and 13, will be the representative of the firm of Benn Brothers, Ltd. (Mr. F. E. Hamer), who will leave in the *Majestic* on September 27. Mr. Hamer, in addition to representing the firm at the conference and several other functions, will be the bearer of messages of greeting to the commercial press of America from Lord Riddell, Lord Burnham, Sir Ernest Benn (chairman of Benn Brothers, Ltd.), and other representative British publishers. Lady Benn (wife of Sir Ernest Benn), is now in America, and in a message just received she speaks very warmly of her reception in the States as associated with a well-known British publishing house, and of the eagerness of American publishers to welcome their British guests next month.

Distribution of Reparation Dyestuffs

To the Editor of THE CHEMICAL AGE.

SIR.—Although no public notification has been made of the fact, the Board of Trade have terminated their arrangement with a body of their own creation, The Central Importing Agency, who were made their sole medium for the distribution of Reparation Dyestuffs, and have now appointed The British Dyestuffs Corporation in their place.

This course indicates that the Board of Trade at last realises that they made a mistake in their first appointment, but surely this should have led the responsible parties to be scrupulously careful in the making of a change.

On the face of it, to place the merchanting of German and competing products in the hands of the Government-endowed and protected British makers of dyestuffs seems to be decidedly Gilbertian. If the British Dyestuffs Corporation is to be the instrument in making Britain self-contained in the manufacturing of essential dyestuffs, how is the merchanting by them upon a remunerative basis of imported German dyestuffs going to assist in attaining this object? It may be further asked what becomes of the much vaunted aspect of national security? Surely the Board of Trade ought to perceive that the National taxpayers have a right to know and to know at once the reasons for the dismissal of the Central Importing Agency and for the appointment of a firm of manufacturers as successors, without any opportunity being given for established and experienced distributing mediums to tender or to negotiate, and apparently regardless of the effect upon other British dyestuff manufacturers.

When Parliament re-assembles there will undoubtedly be plenty of inquiry and criticism, but the Board of Trade will plead *fait accompli*, and another stage of bureaucratic control will be achieved with all its attendant detriment and injustice to legitimate trade.—Yours, etc.,

FREDK. T. T. REYNOLDS,

Chairman of the Executive Council.

Chemical and Dyestuff Traders' Association.

September 13, 1922.

Manganese Deposits in Panama

Copper Elimination Problem

DESCRIBING the manganese deposits of Panama the acting British Consul at Colon states that manganese was discovered on the Caribbean Coast of Panama (then a department of Colombia) in 1879, and a few hundred tons were mined at a small place called Viento Frio, about 40 miles east of Colon. About 200 tons were exported to the United Kingdom for chemical purposes, and a second cargo was lost at sea, which resulted in the bankruptcy of those interested. In 1890 a Special Agent of the United States Government explored the mountains in the vicinity of Viento Frio, and, about eight miles from the coast, discovered a large deposit of manganese. A small railroad was built from the coast to the mine, and over 80,000 tons of high-grade ore, average 54 metallic units manganese, was mined and exported to the United States. In 1916 a deposit at San Blas Point, Mandingo Bay, was developed, and 23,000 tons of ore, average 52 metallic units manganese, were mined and shipped during 1917 and 1918.

The deposit in the Boqueron Valley, in the neighbourhood of Nombre de Dios, is claimed to be the largest deposit of surface ore discovered up to the present time, containing, it is estimated, at least 150,000 tons of surface ore. The manganese deposits, however, are said to be deceptive, and it is dangerous to calculate on more than can be seen. This ore is stated to be very rich in manganese, both metallic and peroxide. About 40,000 tons, thoroughly sampled, will average 56 metallic and at least 85 per cent. peroxide, containing less than 1 per cent. of iron.

It was hoped that it would be useful chemical ore for dry batteries, but unfortunately it was found that about three-fourths of it contains one-half of 1 per cent. copper; it is feared, therefore, that the greater part of the ore will have to be used for steel purposes. If, however, a process could be discovered for eliminating the copper, the Panama Manganese Co., which is taking over the deposit, consider that the value of the ore would be increased by 25 dols. per ton, and an extremely high grade ore could be produced from these deposits.

Chemical Promoter's Bankruptcy

THE statutory first meeting of the creditors of John Henry Robinson Hex, 12, Regent Square, W.C., was held on Friday at Bankruptcy Buildings, Carey Street, W.C., Mr. Vyvyan, Assistant Official Receiver, presiding. Described in the receiving order, made on August 23, on a creditor's petition, as company director, debtor was the promoter of Shepperley's (London), Ltd., manufacturing chemists, and British Pharmacies, Ltd., a company formed with the intention of acquiring and opening chemists' shops in the London area. It appeared that the debtor formed Shepperley's (London), Ltd., early in 1920 with a nominal capital of £5,000 in shares of £1 each, all of which were eventually issued. He received a number of shares as consideration for his services and was appointed managing director of the company at a remuneration of £200 per annum. The objects of the company were to acquire the business of the Shepperley Remedy Co., of Nottingham, which dealt in proprietary medicines. The company carried on business until May, 1921, but the trading was not very satisfactory at that date in consequence of the coal strike and general trade depression. Inasmuch as additional capital was required, it was decided to turn the business into a public company with a nominal capital of £30,000 divided into 20,000 to per cent. cumulative preference and 10,000 ordinary shares, all of £1 each. A prospectus was issued but there was no public response and no shares were ever issued. The company was still in existence but was not trading. The title of this company is Shepperley's Manufacturing Chemists, Ltd., with a registered office in Chancery Lane, W.C. The debtor has further stated that the Registrar of Joint Stock Companies held that the old company must be liquidated before any trading certificate could be issued to a new undertaking and a voluntary liquidator had accordingly been appointed. It was arranged that the shareholders in the old company should receive shares in a reconstructed company, but the former had not yet been finally wound up.

In July last the debtor formed British Pharmacies, Ltd., with a capital of £2,000, and he was appointed managing director at a remuneration of £50 in respect of each branch opened. So far two shops had been opened and he had received 30 £1 preference and 400 ordinary £1 shares as consideration for his services. His liabilities amounted to £500 and were chiefly in respect of money expended on behalf of the new Shepperley Co., his only other liability being in relation to a suretyship for which he had received no consideration. His assets comprised shares estimated to realise £430 and other items of uncertain realisable value. He did not consider himself insolvent, and attributed his present position entirely to the holding up of the trading certificate which had prevented the new company from trading, and to loss of capital invested and money expended on behalf of a company for which, up to the present, he had received no return. The debtor stated that if a short adjournment were granted him he hoped to be in a position to pay his debts in full, and the meeting was adjourned for three weeks.

Chemical Trade of Switzerland

DEALING with the Swiss imports and exports for the first six months of the current year, the Commercial Secretary to H.M. Legation at Berne states that, on the whole, imports have somewhat decreased, while exports have either maintained the same level or slightly increased.

In chemicals there were decreases in imports of tar (279 tons, against 1,542), chloride of calcium (146 tons, against 320), hydrochloric acid (667 tons, against 1,363), sulphuric acid (1,318 tons, against 3,309), and aluminium sulphate (651 tons, against 7,715), whilst there were increases in imports of sulphur from 690 tons to 2,092 tons, and of potash and caustic soda from 1,123 tons to 3,046 tons. Imports of benzine also increased from 15,850 to 18,073 tons, those of aniline from 58 to 508 tons, and of starch and starchy materials from 1,540 to 2,003 tons. The decrease in the import of accessory materials for the manufacture of aniline colours is noteworthy (509 tons, against 1,351). Imports of soap decreased from 2,336 to 809 tons. There were, however, considerable increases in imports of coconut and palm oil (1,128 tons, against 465), tallow and bone fat (992 tons, against 621), petroleum (8,479, against 6,228), and machine oil (4,888, against 3,576 tons).

From Week to Week

PROFESSOR A. F. HOLLEMAN, of Amsterdam, has received the degree of Doctor of Science, *honoris causa*, from Leeds University.

SIR WILLIAM ALEXANDER, chairman of the British Dyestuffs Corporation, will leave England for a visit to the United States on October 4.

AMONG the numerous works closed in Russia between May 1 and August 15 of this year were 16 dye works and two chemical works.

MR. JOHN CHAMBERS, of Rochester, a student at Wye College, has been selected for a course of chemical research work at Rotherby.

MR. WILLIAM THOMSON, of Manchester, was, at the last monthly meeting of the Stockport Town Council, re-appointed public analyst for the borough.

IT IS REPORTED that the German Imperial Potash Council has decided to increase potash prices by 102 per cent. from September 1. The Ministry of Economic Affairs has agreed to this advance.

THE DEATH has occurred in Edinburgh of Professor Alexander Smith, who since 1911 was head of the Chemistry Department of Columbia University, New York. He was a native of Edinburgh.

AN INTERESTING ACCOUNT of the life and work of Mr. George F. Zimmer, A.M.I.C.E., well known as a contributor to THE CHEMICAL AGE, appeared in a recent issue of *Engineering and Industrial Management*.

DR. G. HASWELL WILSON, who has held the posts of lecturer on pathological histology and lecturer on bacteriology in the University of Glasgow, has been appointed to the Chair of Pathology in the University of Birmingham.

SIR ERNEST J. P. BENN, chairman of Benn Brothers, Ltd., the well-known London publishers, has accepted an invitation to preside at the inaugural dinner of the proposed Paint and Varnish Institute, to be held some time in October.

A NOTICE recently issued by the New Zealand Minister of Mines stated that a bonus of 4d. per lb. would be paid on the production of the first 100,000 lb. of good marketable retorted quicksilver, free from all impurities, from any mine in the Dominion.

DAMAGE estimated at £40,000 was caused at Glasgow on Sunday by a fire which destroyed the factory of Falk, Stadelmann and Co., makers of Veritas gas mantles and other lighting fittings. Members of the fire brigade and two employees were injured.

A VALPARAISO MESSAGE to the Anglo-South American Bank, Ltd., states that during the week ended September 1 there was a slackening in the sales of nitrate, the amount disposed of being 135,280 metric quintals for delivery in October. This brings the total sales since the last revision of prices up to 809,829 tons.

AS ILLUSTRATING the importance now attached to fuel economy, we learn from Meldrums, Ltd., Timperley, that last month the firm received orders for their forced draught furnaces from one hospital, one sawmill, one laundry, six gas departments, one pumping station, and four collieries, as well as several for their destructors. It is noteworthy that a good proportion of these were repeat orders.

IN CONNECTION with the visit of the British Association to Hull, the University of Leeds has conferred the honorary degree of D.Sc. upon Sir C. S. Sherrington, G.B.E., President; Mons. M. de Broglie, Institut d'Optique, Paris; Dr. C. G. Joh. Petersen, Director of the Danish Biological Station, Copenhagen; and Professor P. Weiss, Director of the Institute de Physique, University of Strasbourg.

AMONG the lectures organised by the London County Council for school teachers, during the session 1922-23, are five lectures on the constitution of matter, by Sir William Bragg; ten lectures on science in elementary schools, by Dr. R. S. Clay; and one lecture on the atom, by Professor A. Smithells. In addition to the courses a series of four special lectures includes one by Sir William Bragg on the significance of crystal analysis.

ON THURSDAY, September 7, a fire broke out at the works of the British Dyestuffs Corporation, Ltd., Blackley, Manchester. The outbreak occurred in the dyestuffs stores, and shortly afterwards there was a slight explosion, no very

serious damage, however, being done. The works fire brigade and the brigade from the adjoining works of W. J. Morgan and Co., match manufacturers, had the fire well under control before the arrival of the Manchester Corporation brigade.

THE COUNCIL of the Institute of Chemistry have agreed to recognise the Liverpool Central Technical School for the training of candidates for the examinations for the Associateship of the Institute. Mr. A. E. Findley, the senior lecturer in chemistry, has been elected a Fellow of the Institute. National Certificates in Chemistry have been awarded to W. F. Bennett, W. S. Fulton, T. E. Fore, T. Wood, and E. E. Fletcher. W. F. Bennett and T. E. Fore secured distinction in organic chemistry.

ATTEMPTS have been commenced by an Englishman, states a *Times* correspondent, to develop a new process suitable for treating the Sicilian sulphur ore, which depends for its success on making use of small traces of bitumen, naturally present in the ore, to replace an equivalent quantity of the sulphur sacrificed by the processes at present in use to produce the heat required. A first experiment with improvised plant is reported to have given a yield of eight per cent. above the customary yield, with a saving of about half the time required by the old process and with the injurious effects on the health of the melters entirely obviated.

THE BRITISH Commercial Agent for Egypt has notified the Department of Overseas Trade that the Frontier Districts Administration, Alexandria, is inviting tenders for the supply of consumable stores, oils and paints. Tenders, on the proper form, accompanied by a provisional deposit of 2 per cent. of the total value of the tender, should reach the Director of Stores, Frontier Districts Administration, Alexandria, by noon on October 10 next. The schedule, conditions of tender, and specifications can be seen by United Kingdom firms interested on application to the Department of Overseas Trade (Room 84), 35, Old Queen Street, London, S.W.1.

ALTHOUGH arrangements have been made for the provision of food-poisoning anti-toxin by the Ministry of Health, the authorities are not alarmed by the appearance of the botulism germ in this country, and do not at present contemplate any legislation with a view to imposing upon dealers in canned goods any obligation to revise their methods of sterilisation. It is probable, however, that the recommendation that all preserved foods should have a distinctive mark, by which details of manufacture can be traced, will be adopted by the Ministry. Dr. M'Fadden, the Ministry's medical adviser, is preparing a statement of his views on the matter for Sir Alfred Mond.

MR. CHARLES CROWTHER, M.A. (Oxon), Ph.D., who at the age of 46 years succeeds Mr. P. Hedworth Foulkes as principal of the Harper-Adams College, was the head of the chemical department of the Harris Institute and the Lancashire County Council School of Agriculture, Preston, from 1901 until 1903. During the following ten years he was lecturer in agricultural chemistry in the University of Leeds, where, for six years afterwards, he was Professor of Agricultural Chemistry and head of the Institution for Research in Animal Nutrition. In 1917-1919 he was technical adviser of the Board of Agriculture and Fisheries, and more recently has been acting as director of research for the Olympia Agricultural Co., Ltd. Mr. Crowther has written extensively on subjects related to agricultural science.

DURING the annual tour of inspection of experimental and commercial hop gardens organised by the Institute of Brewing last week, some dozens of buyers and producers of hops attended to witness and hear explained the progress of the important research and demonstration work begun many years ago, and greatly extended in the past few years at the South-Eastern Agricultural College, Wye, largely at the instigation and with the generous support of the Institute of Brewing. In the course of an address, Mr. H. E. Field, president of the Institute, referred to the important developments at the new station at East Malling, where new oast-houses for experimental purposes have been constructed at a cost of £1,400, contributed equally by the Ministry of Agriculture and the Institute of Brewing. The Institute has done a valuable service to the hop industry in devising and developing a wide scheme of investigations in growing and curing hops. It is now extending its attentions to the production of barley with similarly encouraging results.

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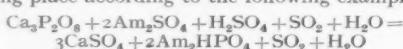
Abstracts of Complete Specifications

184,197. CELLULOSE ESTERS, PROCESS FOR UTILISING. J. Duclaux, 34, Rue du Bac, Paris. Application date, February 1, 1921.

In the manufacture of sheets or threads from cellulose nitrate, acetate, or butyrate, it is found that the products do not take dyes under the same conditions as natural textiles, while the evaporation of solutions of cellulose esters in volatile solvents sometimes leaves white or opalescent films. The object is to avoid these disadvantages. The solution of the ester in a volatile solvent is mixed with a small quantity of an organic substance which is soluble in water and is a solvent of the ester, but is only slightly volatile or non-volatile. The volatile solvent is evaporated from this mixture, and the soluble substance is then removed by washing with water. The material obtained by evaporating such a solution of cellulose ester is transparent, and the material obtained by subsequent washing will take a dye like a natural fibre. Suitable water-soluble substances are formamide, acetamide, their higher homologues, chloral, and chloral hydrate, and these are employed in proportions up to 10 per cent. Acetamide is suitable for use with any of the solvents, particularly with formates, acetates, etc., of methyl, ethyl, butyl or amyl alcohol. Very volatile collodion is obtained by using as a solvent for the cellulose ester, methyl or ethyl formate 50 parts, methyl or ethyl alcohol 50 parts, and acetamide 1 to 2 parts. If butyl or amyl formate or acetate is used, instead of methyl or ethyl formate, a slowly evaporating collodion is obtained.

184,206. SOLUBLE PHOSPHATES, PROCESS OF MANUFACTURING. J. G. Williams, 2, Melbourne Road, West Bridgford, Nottingham. Application date, November 10, 1921.

The soluble phosphate is produced by the reaction between a water-soluble sulphate such as sodium, potassium or ammonium sulphate, and calcium phosphate in the presence of water and sulphur dioxide. The calcium phosphate may be bone ash, mineral phosphate, or precipitated calcium hydrogen phosphate. The products consist of a soluble phosphate, calcium sulphate and a soluble sulphite. The reaction is reversible, so that some soluble sulphate is always present, but this can be removed by fractional crystallisation. The sulphur dioxide may be recovered by heating the liquor after filtration. Alternatively sulphur dioxide may be passed through a mixture of calcium phosphate and water, and the soluble sulphate then added, or the sulphur dioxide dissolved in a solution of the sulphate and the calcium phosphate then added. Nitre cake may be employed if sodium phosphate is to be prepared, and the sulphuric acid present in the nitre cake is found to be an advantage. If one molecule of the soluble sulphate is replaced by one molecule of sulphuric acid the production of the soluble sulphite is avoided, the reaction then taking place according to the following example:—

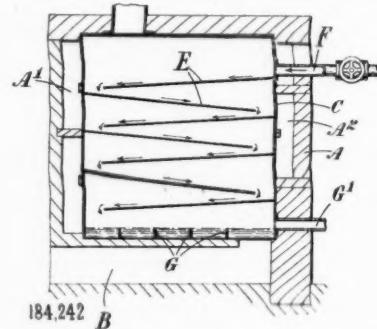


The sulphur dioxide may be replaced by formic or acetic acid, or by carbon dioxide or hydrogen sulphide. Reference is directed in pursuance of Section 7, Subsection 4, of the Patents and Designs Acts, 1907 and 1919, to Specification No. 26,097/1912.

184,242. TAR AND OTHER LIQUIDS, PROCESS AND APPARATUS FOR DISTILLING. W. Glossop, Highfield, Hipperholme, near Halifax; L. Bradley, Thornhill House, Hipperholme, near Halifax; and R. W. Willsdon, Copmanthorpe, York. Application date, May 2, 1921.

The apparatus is for distilling liquids containing water, such as tar, in the form of a thin moving film in such a way that the water and other vapour passes through the film and abstracts the constituents of lower boiling point. A still C is contained within a casing A of refractory material having flues A¹, A² at the front and back connected by other flues at the side. The furnace chamber B is arranged at the bottom, and the flues are provided with horizontal baffles to deflect the gases from one end to the other in a zigzag course. The still C contains a number of trays E attached to each wall

alternately, and sloping in opposite directions alternately. The tar is supplied through an inlet F on to the top of the uppermost tray, and flows downwards over the trays in succession in a thin film. A series of baffles G are arranged at



the bottom and the residue passes over these to the outlet G¹. The vapour evolved in the lower parts of the still is scrubbed by its passage through the thin film of liquid falling from each tray on to the tray next below, so that the volatile fractions are abstracted from the descending liquid.

184,244. POTASSIUM BICARBONATE FROM POTASSIUM CHLORIDE SOLUTIONS, PROCESS FOR THE ELECTROLYTIC PRODUCTION OF. Chemische Fabrik Griesheim Elektron, 51, Gutleutstrasse, Frankfurt on Main, Germany; and R. Suchy, 62, Kaiserstrasse, Griesheim on Main, Germany. Application date, May 2, 1921.

Potassium bicarbonate is produced from potassium chloride by a diaphragm process in which the caustic potash in the catholyte is neutralised with bicarbonate. After electrolysis, when the bicarbonate is transformed into neutral carbonate, the greater part of the carbonate produced by electrolysis may be precipitated as bicarbonate by treating the final solution with carbon dioxide. The bicarbonate may be filtered off and washed, and may be calcined to obtain the carbonate. In this invention, before the final solution is treated with carbon dioxide, the amount of potassium chloride consumed from the catholyte is replaced by fresh chloride. The potassium carbonate produced by the electrolysis is thus precipitated as bicarbonate, and the bicarbonate originally present remains in solution so that the original liquor is regenerated and is ready for use again for further electrolytic treatment.

184,281. LIQUID HYDROCARBONS, REFINING. A. E. Dunstan, Meadhurst, Cadbury Road, Sunbury-on-Thames. Application date, May 12, 1921.

The process is for removing sulphur compounds in the refining of benzene, kerosene or other distillates from petroleum, shale oil or the like. The hydrocarbon is first treated with 0.5 to 0.75 per cent. of a 10 per cent. solution of a caustic alkali. The hydrocarbon is agitated for about one hour, the solution of caustic alkali is separated, and the hydrocarbon is then treated with a mixture of sodium hypochlorite and free alkali. The presence of the free alkali prevents chlorination of the hydrocarbon, and stabilises the hypochlorite. The treatment may be carried out in a vessel in which a solution of salt is electrolysed to produce the hypochlorite. The sodium hypochlorite is removed, and the hydrocarbon finally washed with alkali, which alkali may subsequently be used for the preliminary treatment of the hydrocarbon. In an example, crude oil with a sulphur content of 1.1 per cent., was distilled and the distillate (amounting to 35 per cent.) was subjected to the above treatment. The product was then distilled to yield petrol, and a kerosene residue, and the sulphur content of the distillate was found to be 0.007 per cent. The amount of reagent used for treating a hydrocarbon is determined by analysing the hydrocarbon to determine the sulphur content. The hypochlorite used should be sufficient to provide one unit of oxygen for each unit of sulphur.

184,271. CLAY TREATMENT OF. W. Feldenheimer, 20, Holborn Viaduct, London, E.C.1; and W. W. Plowman, 83, St. Leonards Road, East Sheen, Surrey. Application date, May 9, 1921.

In the process for purifying clay by suspending it in a liquid medium by the aid of a peptising agent, allowing the impurities to separate out, and then precipitating the clay by adding a flocculating agent, it is found that the usual peptising or deflocculating agents are not successful with a number of clays, while in the case of other clays, the limits of concentration of the deflocculator which will maintain the clay in suspension are too close together for commercial working. A peptising agent has now been found by which some of these clays may be satisfactorily treated. The deflocculating agent consists of a dilute aqueous solution containing meta-phosphoric acid, or alkali meta-phosphate such as sodium meta-phosphate. The free acid may be used in conjunction with an alkali such as sodium carbonate in excess. In an example, a Fraddon china clay is made into a 5 per cent. mixture with soft water, and an aqueous solution of meta-phosphoric acid added in the proportion of 2 to 3 lb. per ton of clay. The mixture is allowed to stand for four hours, the clay suspension is run off, and the clay is precipitated by adding an aqueous solution of alum in the same proportions as that of the meta-phosphoric acid. Sodium bicarbonate may alternatively be used as a flocculating agent in the proportion of 1.5 parts to each part of meta-phosphoric acid used.

184,284. AMINES FROM PHENOLIC COMPOUNDS, MANUFACTURE OF. W. L. Galbraith, of The Gas Light and Coke Co., Horseferry Road, Westminster, London, S.W.1; W. V. Shannan, W. G. Adam and N. E. Siderfin, of The Gas Light and Coke Co., Beckton, London, E.16. Application date, May 13, 1921.

The process is for producing amines from unsubstituted phenols, more particularly β -naphthyl-amine from β -naphthol. In the known process for producing amines by heating the phenol in an autoclave with ammonia and a solution of ammonium sulphite, it has been found that the use of ammonium sulphite is not essential to effect the conversion at a low temperature, but that other ammonium salts such as ammonium chloride in conjunction with a sulphite of a fixed alkali, such as sodium sulphite, may be used. The phenol and the sulphite may be in the form of the reaction product obtained when the phenol is prepared by fusion of the corresponding sulphonate acid with alkali. The phenol and sulphite, if added separately, should be approximately in equal molecular proportions. In estimating the amount of ammonium salt necessary, allowance should be made for decomposition of part of the salt due to the presence of free alkali and alkali hydroxylate in the materials. In an example, a mixture of crude sodium β -naphtholate 4,800 grams, ammonium chloride 2,053 grams, aqueous ammonia (0.880) 2,617 cc., and water 9,280 cc., is heated in an autoclave for 14 hours at 170° C. under a pressure of 180 lb. per sq. in. The gaseous ammonia is then drawn off and absorbed in cold water, and the residue in the autoclave is freed from unchanged naphthol by treatment with caustic soda solution. The residue is then distilled under reduced pressure, and the following yield calculated on the amount of sodium naphthalene- β -monosulphonate used for the alkali fusion is obtained:—Crude β -naphthyl-amine 90.6 per cent., and unchanged naphthol 6.6 per cent. On distillation, 79.7 per cent. of pure β -naphthyl-amine is obtained.

184,402. METALLIFEROUS MATERIALS, PROCESS FOR DIS-SOLVING OUT OR RECOVERING THE METAL CONSTITUENTS OF. H. Bardt, 818, Agustinas Street, Santiago, Chile. Application date, October 10, 1921.

Ores, residues, alloys, and the like are treated for the recovery of copper by the use of dilute sulphuric acid at ordinary temperature, together with sufficient nitric acid to oxidise the copper. The solution of the copper is accelerated by leaching at a pressure of several atmospheres, or by adding a catalyst such as platinum, or a salt of a metal having more than one degree of oxidation, such as vanadium, osmium, cerium or manganese. The catalyst is preferably used in conjunction with leaching under high pressure. Oxides of nitrogen are evolved, and may be reconverted into nitric

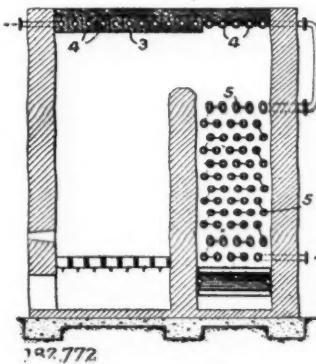
acid for use again. A solution of copper sulphate is obtained and is electrolysed with insoluble anodes to obtain the copper. Dilute sulphuric acid is also produced in the electrolysis, and is used for a further leaching operation. In an example, the leaching and electrolysis may be carried out in the same vessel. The necessary quantities of the reagents are placed in a heat-insulated autoclave, and the liquor is electrolysed until the oxygen liberated at the anode produces a pressure of about 1.5 atmospheres. The leaching is then allowed to proceed until the copper is dissolved.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in *THE CHEMICAL AGE* when they became open to inspection under the International Convention: 163,304 (Minami Manshu Tetsudo Kabushiki Kaisha) relating to the manufacture of anhydrous chlorides of alkaline earth metals, see Vol. V., p. 77; 167,143 (A. D. Little, Inc.) relating to the preparation of cellulose butyrate, see Vol. V., p. 411; 168,324 (O. von Faber) relating to a process for recovering iodine, see Vol. V., p. 534.

International Specifications not yet Accepted

182,772. FURNACES. Power Specialty Co., 111, Broadway, New York. (Assignees of J. Primrose, 111, Broadway, New York.) International Convention date, July 2, 1921.

In a furnace for an oil still, the oil-heating tubes 5 are connected in series with a series of exposed tubes 4 arranged in the roof of the furnace immediately above the heating com-



partment, and with a series of oil tubes encased in refractory blocks 3 above the fire chamber. Over-heating of the top row of oil tubes 5 by radiation from a highly heated roof is thus avoided. The tubes exposed to the hot gases are of steel enclosed in corrugated rings of cast iron.

182,802. MELTING AND REDUCING FURNACES. A. Ziegler, 2, Privatstrasse, Volklingen, Saargebiet, Germany. International Convention date, July 5, 1921.

The furnace is capable of generating a high temperature for the manufacture of calcium carbide or ferro-silicon, and is of the kind in which oxygen or enriched air is supplied for combustion. The oxygen is supplied through a tube of carbon or other material capable of resisting high temperatures, which projects deeply into the charge so that the outer walls of the furnace are not subjected to the most intense heat. The tube may be placed on the top of the charge and be fed downwards as melting proceeds, or the tube may be placed in position and the charge piled around it.

182,820. CELLULOSE BUTYRATES AND PLASTIC COMPOSITIONS. A. D. Little, Inc., Charles River Road, Cambridge, Mass., U.S.A. (Assignees of G. J. Esselen, Swampscott, Mass., U.S.A., and H. S. Mork, South Boston, Mass., U.S.A.) International Convention date, April 10, 1922.

Cellulose is treated with butyric anhydride and butyric acid in the presence of a catalyst to produce cellulose butyrate. The cellulose is impregnated with the catalyst in the presence of a carrier such as acetic acid, or butyric acid containing a little water and a solvent such as methyl, ethyl, or butyl alcohol, acetone, diacetone alcohol, or ethyl acetate, and excess of liquid is then pressed from the cellulose. The cellulose is then converted into butyrate in a bath containing

butyric anhydride 465 parts and butyric acid 400 parts. After the product becomes soluble in chloroform the reaction may be accelerated by adding sulphuric acid, and the reaction is continued until the product is soluble in alcohol-benzene. The butyrate may be employed for manufacturing artificial silk, films, lacquers and the like, and is soluble in acetylene tetrachloride, acetone, ethyl acetate, phenol, hot alcohol and benzol, alcohol-carbon tetrachloride, and hot solvent naphtha.

183,117. ZINC, OBTAINING BY ELECTROLYSIS. J. T. Ellsworth, Park City, Utah, U.S.A. International Convention date, July 21, 1921.

The ore or other material containing zinc is roasted to oxidise it and convert sulphides into oxides, and is then leached with the spent electrolyte from a previous operation, which contains sulphuric acid. The action proceeds until the acidity is reduced to 0.01-0.15 per cent., and the solution is then filtered off and finally neutralised with metallic zinc, copper being precipitated at the same time. About 0.1 per cent. of lime or caustic soda is then added and the solution evaporated until, after removal of precipitated basic salts and dilution to the original volume, no supersaturation can occur in any of the later stages. Ferric hydrate, and other metal compounds are precipitated by adding an oxidising agent before or during the concentration. Final traces of copper and cadmium are removed by adding zinc dust, and the solution is then filtered and electrolysed. The precipitated basic salts obtained during concentration are heated to 100°-300° C. to dehydrate the gelatinous silica and produce alkali and alkaline earth metal salts such as magnesium, calcium, sodium or potassium sulphates which are less soluble in dilute sulphuric acid than the zinc salts. The zinc salts are dissolved out by dilute sulphuric acid until the concentration is the same as that of the main solution. The solution, if iron is present, is then added to the main solution before the removal of iron from the latter, or if iron is absent, the addition is made after dilution of the main solution. Copper and cadmium may be recovered from the residues.

183,123. DYES. Durand and Huguemin Soc. Anon. Basle, Switzerland. International Convention date, July 15, 1921. Addition to 166,530.

Specification 166,530 (see THE CHEMICAL AGE, Vol. V, p. 383) describes a process for producing triaryl-methane dyes by oxidising a mixture of methylene-dianilido-o-oxyaryl-carboxylic acid and an o-oxyaryl-carboxylic acid. In the present invention the methylene-dianilido-o-oxyaryl-carboxylic acid is replaced by methylene disalicyl amide or a homologue or analogue, or nitro- or chloro-derivatives. In an example, salicyl amide is condensed with formaldehyde in concentrated sulphuric acid, then mixed with salicylic acid, o-cresotinic acid, or m-chloro-salicylic acid, and then oxidised by sodium nitrite. A similar compound is obtained by condensing o-cresotinic amide with formaldehyde and then oxidising as above. The dyes obtained are yellower and faster to washing and chlorine than those of specification 166,530.

LATEST NOTIFICATIONS.

- 185,399. Method of solidifying fibrous substances. Lishina, E. September 1, 1921.
- 185,403. Manufacture of thiohydriins. Farbwerke vorm. Meister, Lucius, and Brüning. August 27, 1921.
- 185,421. Process for transforming vegetable matter into paper pulp. Mourlaque, G. A. September 1, 1921.

Specifications Accepted, with Date of Application

- 159,196. Artificial base exchanging bodies. Preparation of American Zeolite Corp. February 19, 1920.
- 163,706. Sulphates. Process and apparatus for the continuous production of. Soc. Anon. de Produits Chimiques Etablissements Maletra. May 25, 1920.
- 181,309. Oxygen. Process and apparatus for removing from Liquids. Union Thermique. June 8, 1921.
- 184,825. Ethers of Carbohydrates. Process for the Production of. G. Young. September 12, 1921.
- 184,833. Nitrogenous manures. Manufacture of. D. L. Monaco. April 7, 1921.
- 184,843. Ferro tungsten and ferro molybdenum. Manufacture of. J. M. Skelley, J. Merson, and Continuous Reaction Co., Ltd. April 23, 1921.

- 184,844. Ferrous alloys. H. A. Skelley, A. B. Smith and Continuous Reaction Co., Ltd. April 23, 1921.
- 184,880. Refining clay, especially china clay. Plauson's (Parent Co.), Ltd. (H. Plauson). May 21, 1921.
- 184,887. Gas generators and/or retorts. F. Umpleby and H. Powers. May 23, 1921.
- 184,912. Carbon-free ferro molybdenum. Manufacture or production of. W. L. Turner. June 1, 1921.
- 184,938. Alkali salts. Operation of processes and cells for electrolytic decomposition of. M. Wilderman. June 16, 1921.
- 184,948. Titanium ores containing iron. Process of treating. G. Carteret and M. Devaux. June 27, 1921.
- 184,955. Tanning of hides and skins. P. J. C. Margotton. June 30, 1921.
- 184,961. Condensation products of phenolic bodies with aldehydic compounds. Lorival Manufacturing Co., Ltd., and A. A. Drummond. July 7, 1921.
- 184,966. Sulphuric acid. Process for producing the effect of the Glover tower in the manufacture of—without the use of Glover towers. T. Schmiedel. July 12, 1921.
- 184,984. Artificial resins. Manufacture of. A. Heinemann. July 27, 1921.
- 184,991. Refining mineral oils obtained from earth oil. Method of. C. R. Ehlers. July 29, 1921.
- 185,037. Pulverising, mixing and grading. Apparatus for. W. Clark, G. Dawson and W. A. Dawson. October 10, 1921.

Applications for Patents

- Bader, W., and British Cellulose and Chemical Manufacturing Co., Ltd. Process for separation of liquids from mixtures. 24128. September 6.
- Beach, A. C. G. Calculating-device for chemists. 24240. September 7.
- Clark, T. W. F., and Pearson and Co., Ltd., E. T. Process for producing a potent preparation of vitamin A. 23944. September 4. Elektrizitätswerk Lonza. Iron alloys. 24176. September 6. (Switzerland, Sept. 10, 1921.)
- Elektrizitätswerk Lonza. Method for application of alloys of silicon and calcium in metallurgical processes. 24271. September 7. (Switzerland, Sept. 10, 1921.)
- Farbenfabriken vorm. F. Bayer and Co. Process of absorbing ethylene and its homologues. 24410. September 8. (Germany, Sept. 9, 1921.)
- Foulds, M., and Leblanc, M. Copper-oxide cells. 24279. September 7. (France, Sept. 8, 1921.)
- Germot, A. Process for direct obtainment of metallic antimony. 24361. September 8.
- Germot, A. Process of manufacture of oxide of white antimony. 24362. September 8.
- Goodwin, C. J. Manufacture of oxides of nitrogen and nitric acid. 24008. September 5.
- Klipstein and Sons Co., E. C., and Thompson, W. P. Manufacture of sulphide dye-stuffs, and processes of dyeing therewith. 24002. September 5.
- Meade, A. Telphers. 23908. September 4.
- Meade, A. Means for handling hot coke. 24234. September 7.
- Price, J. W. F. Chemical compound. 24315. September 8.
- Rigby, T. Heating liquids or admixed solids and liquids in evaporative treatment. 23911. September 4.
- Soc. de Stearine et Savonnerie de Lyon. Process for manufacturing cellulose ether salts. 24153. September 6. (France, July 29.)
- Tinker, F. Production of petrol, etc. 24062. September 5.
- Vautin, C. Production of metallic copper. 24288. September 7.

The Technical Chemist's Part in Industry

In a letter emphasising the important part the technical chemist plays in industrial advances, Mr. W. J. U. Woolcock, M.P., quotes the case of argon as one example, and proceeds: "The synthesis of indigo is another instance of academic research translated into a practical success; so with the making of artificial silk, of stainless steel, of incandescent mantles, and the hardening of fats that yields margarine. And surely the recent replacement of German dyes by British has been as remarkable as any other issue of this wedding of scientific knowledge to technical ability. In the research laboratories of our country the secret of one fine chemical or dyestuff after another has been discovered with such success that we are fast becoming independent in these essential substances. It is the technical chemist who has made production on the large scale possible. It is on him, as well as on the academic worker, that our country's industry to-day depends. The generous recognition of this by the pure scientist will enable us the more speedily to arrive at many goals from which, as Sir Charles Sherrington at least has the vision to perceive, a start might be made for others."

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

LONDON, SEPTEMBER 14, 1922.

THE past week has witnessed a period of quiet, steady trade. The business is slowly recovering after the holidays and the outlook is brighter than it has been for some considerable time. Conditions are certainly improving, particularly in the industrial areas.

Export trade has been rather quiet.

General Chemicals

ACETONE has advanced in price, and it is generally thought that we are a good way yet from the top of the market. ACID ACETIC is in active demand and likely to advance further in price.

ACID CITRIC is slow and uninteresting.

ACID FORMIC is a fair market; price unchanged.

ACID LACTIC has been rather quiet, but stocks are firmly held.

ACID TARTARIC is very slow of sale, and the tendency is in buyers' favour.

BARIUM CHLORIDE is not quite so firm; the extremely high price has seriously interfered with the demand.

COPPER SULPHATE.—Unchanged.

CREAM OF TARTAR is in fair request; price unaltered.

FORMALDEHYDE is a firm market, and the demand is fair.

IRON SULPHATE is uninteresting.

LEAD ACETATE is firm in price, with a number of sales of a hand-to-mouth variety.

LEAD NITRATE.—A small business is passing; price unchanged.

LITHOPONE.—Quiet but firm in tone.

MAGNESIUM CHLORIDE.—Unchanged.

POTASSIUM CARBONATE remains a weak market.

POTASSIUM CAUSTIC.—The increased demand has not been maintained, and the tendency is weaker.

POTASSIUM CHLORATE is in good demand at recent values.

SODIUM HYPOSULPHITE is cheaply offered from the Continent.

SODIUM PHOSPHATE is idle, and values are drooping.

SODIUM PRUSSIATE.—Spot supplies are immediately absorbed, and the market remains firm.

WHITE LEAD.—Unchanged.

ZINC OXIDE has been in fair demand and is particularly firm in tone.

Coal Tar Intermediates

There is little bulk business about, but, on the whole, the general tone is rather better, and fair export inquiries are in the market.

ALPHA NAPHTHOL is in demand on export account, and the price is firm.

ALPHA NAPHTHYLAMINE is a small home business.

ANILINE OIL passes regularly into consumption at last quoted price.

BETA NAPHTHYLAMINE is the turn easier, but a fair home trade is passing.

BETA NAPHTHYLAMINE is without special feature.

DIMETHYLANILINE.—Good export inquiry.

DIPHENYLAMINE is very firm, with several inquiries in the market both for home and export.

"G" SALT is quiet.

"H" ACID is in demand for home consumption.

NAPHTHONIC ACID is steady.

NITROBENZOL is rather easier.

PARANITRANILINE is quiet.

PARAPHENYLENEDIAMINE is firm, with export business moving.

RESORCIN.—A fair number of inquiries have been received.

XYLIDINE is in demand for export.

Coal Tar Products

The market in different coal-tar products maintains a steady tone, and there is little change to report from last week. 90's BENZOL maintains a good demand, and is worth from 2s. 1d. per gallon on rails.

PURE BENZOL is not very active, and is worth 2s. 4d. to 2s. 5d. per gallon on rails.

CREOSOTE OIL is steady at prices ranging from 5s. 4d. to 6s. 4d. per gallon in the North, and 6s. 4d. to 7s. 4d. on rails in the South.

CRESYLIC ACID is somewhat irregular, although a fair amount of business is being done. It is worth about 2s. 6d. on rails for September delivery, while October/December is worth about 2s. 4d. per gallon. These prices are for the Pale quality, 97/99%. The Dark quality, 95/97%, is worth about 2s. to 2s. 1d. per gallon on rails.

SOLVENT NAPHTHA is fairly well booked up for prompt delivery, and is worth 1s. 8s. 4d. to 1s. 9d. per gallon on rails.

HEAVY NAPHTHA has a poor inquiry, and is quoted at 1s. 7d. per gallon.

NAPHTHALENE is weak, and has very little business.

PITCH remains firm with strong demand, and prices are still advancing. To-day's quotations are 90s. to 95s. per ton f.o.b. London, 8s. 6d. to 90s. per ton f.o.b. East Coast and West Coast ports.

Sulphate of Ammonia

There is no change to report.

Current Prices

Chemicals

	Per	£	s.	d.	Per	£	s.	d.
Acetic anhydride.....	.lb.	0	1	8	to	0	1	10
Acetone oil	ton	80	0	0	to	82	10	0
Acetone, pure.....	ton	90	0	0	to	92	0	0
Acid, Acetic, glacial, 99-100%.....	ton	67	0	0	to	68	0	0
Acetic, 80% pure.....	ton	47	0	0	to	48	0	0
Arsenic, liquid, 2000 s.g.....	ton	67	0	0	to	70	0	0
Boric, cryst.....	ton	60	0	0	to	65	0	0
Carbolic, cryst. 39-40%.....	lb.	0	0	6	to	0	0	6
Citric	lb.	0	2	2	to	0	2	3
Formic, 80%.....	ton	65	0	0	to	66	0	0
Gallic, pure.....	lb.	0	2	11	to	0	3	0
Hydrofluoric.....	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.....	ton	40	0	0	to	43	0	0
Lactic, 50 vol.....	ton	43	0	0	to	45	0	0
Nitric, 80 Tw.....	ton	30	0	0	to	31	0	0
Oxalic	lb.	0	0	7½	to	0	0	8
Phosphoric, 1.5.....	ton	38	0	0	to	40	0	0
Pyrogallic, cryst.....	lb.	0	5	9	to	0	6	0
Salicylic, Technical	lb.	0	0	10½	to	0	1	6
Salicylic, B.P.....	lb.	0	1	5	to	0	1	6
Sulphuric, 92-93%.....	ton	7	10	0	to	8	0	0
Tannic, commercial.....	lb.	0	2	3	to	0	2	9
Tartaric	lb.	0	1	4½	to	0	1	5
Alum, lump.....	ton	10	0	0	to	10	10	0
Alum, chrome.....	ton	28	0	0	to	29	0	0
Alumino ferric.....	ton	9	0	0	to	9	5	0
Aluminium, sulphate, 14-15%.....	ton	10	0	0	to	11	0	0
Aluminium, sulphate, 17-18%.....	ton	11	10	0	to	12	0	0
Ammonia, anhydrous	lb.	0	1	8	to	0	1	9
Ammonia, .880.....	ton	33	0	0	to	35	0	0
Ammonia, .920.....	ton	21	0	0	to	23	0	0
Ammonia, carbonate.....	lb.	0	0	4	to	0	0	4½
Ammonia, chloride.....	ton	60	0	0	to	65	0	0
Ammonia, muriate (galvanisers)	ton	35	0	0	to	37	10	0
Ammonia, nitrate (pure).....	ton	35	0	0	to	40	0	0
Ammonia, phosphate.....	ton	74	0	0	to	75	0	0
Ammonia, sulphocyanide.....	lb.	0	1	10	to	0	2	0
Amyl acetate.....	ton	175	0	0	to	185	0	0
Arsenic, white, powdered.....	ton	42	0	0	to	44	0	0
Barium, carbonate, 92-94%.....	ton	12	10	0	to	13	0	0
Barium, Chlorate.....	ton	60	0	0	to	68	0	0
Barium Chloride.....	ton	23	0	0	to	23	10	0
Nitrate.....	ton	27	10	0	to	30	0	0
Sulphate, blanc fixe, dry.....	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp.....	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%.....	lb.	0	1	0	to	0	1	3

	Per	£	s.	d.	Per	£	s.	d.
Bleaching powder, 35-37%	ton	12	0	0	to	33	0	0
Borax crystals	ton	29	0	0	to	0	14	0
Caffein	lb.	0	13	0	to	0	14	0
Calcium acetate, Brown	ton	9	10	0	to	10	10	0
Grey	ton	14	10	0	to	15	0	0
Calcium Carbide	ton	16	0	0	to	17	0	0
Chloride	ton	6	10	0	to	—		
Carbon bisulphide	ton	50	0	0	to	52	0	0
Casein technical	ton	47	0	0	to	55	0	0
Cerium oxalate	lb.	0	4	6	to	0	4	9
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	6	0	to	0	6	0
Oxide, black	lb.	0	9	6	to	0	10	0
Copper chloride	lb.	0	1	2	to	0	1	3
Sulphate	ton	26	10	0	to	27	0	0
Cream Tartar, 98-100%	ton	108	0	0	to	110	10	0
Epsom salts (see Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	68	10	0	to	70	0	0
Formusol (Rongalite)	lb.	0	2	6	to	0	2	9
Glauber salts, commercial	ton	5	0	0	to	5	10	0
Glycerine, crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal.	0	2	5	to	0	2	6
Iron perchloride	ton	30	0	0	to	32	0	0
Iron sulphate (Copperas)	ton	4	0	0	to	4	5	0
Lead acetate, white	ton	41	0	0	to	42	0	0
Carbonate (White Lead)	ton	43	0	0	to	47	0	0
Nitrate	ton	46	10	0	to	48	10	0
Litharge	ton	35	10	0	to	36	0	0
Lithopone, 30%	ton	23	10	0	to	24	0	0
Magnesium chloride	ton	7	0	0	to	7	10	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts com-								
mercial	ton	8	0	0	to	8	10	0
Sulphate (Druggists')	ton	13	10	0	to	14	10	0
Manganese, Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	60	0	0	to	62	0	0
Methyl acetone	ton	70	0	0	to	75	0	0
Alcohol, 1% acetone	ton	70	10	0	to	75	0	0
Nickel sulphate, single salt	ton	49	0	0	to	51	0	0
Ammonium sulphate, double salt	ton	51	0	0	to	52	0	0
Potash, Caustic	ton	33	0	0	to	34	0	0
Potassium bichromate	lb.	0	0	6	to	—		
Carbonate, 99%	ton	31	0	0	to	33	0	0
Chloride, 80%	ton	12	0	0	to	12	10	0
Chlorate	lb.	0	0	4	to	0	5	0
Metabisulphite, 50-52%	ton	84	0	0	to	90	0	0
Nitrate, refined	ton	45	0	0	to	47	0	0
Permanganate	lb.	0	0	9	to	0	10	0
Prussiate, red	lb.	0	4	6	to	0	4	9
Prussiate, yellow	lb.	0	1	7	to	0	1	8
Sulphate, 90%	ton	13	0	0	to	13	10	0
Sal ammoniac, firsts	cwt.	3	3	0	to	—		
Seconds	cwt.	3	0	0	to	—		
Sodium acetate	ton	24	10	0	to	24	15	0
Arsenite, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	5	to	—		
Bisulphite, 60-62%	ton	23	0	0	to	24	0	0
Chlorate	lb.	0	0	3	to	0	0	4
Caustic, 70%	ton	20	10	0	to	21	0	0
Caustic, 76%	ton	21	10	0	to	22	10	0
Hydrosulphite, powder, 85%	lb.	0	1	9	to	0	2	0
Hyposulphite, commercial	ton	12	10	0	to	13	10	0
Nitrite, 96-98%	ton	29	10	0	to	30	0	0
Phosphate, crystal	ton	16	10	0	to	17	0	0
Perborate	lb.	0	0	11	to	0	1	0
Prussiate	lb.	0	1	11	to	0	0	11
Sulphide, crystals	ton	12	10	0	to	13	10	0
Sulphide, solid, 60-62%	ton	21	10	0	to	23	10	0
Sulphite, cryst.	ton	12	10	0	to	13	0	0
Strontium carbonate	ton	55	0	0	to	60	0	0
Strontium Nitrate	ton	50	0	0	to	55	0	0
Strontium Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Sulphur, Flowers	ton	13	0	0	to	14	0	0
Roll	ton	13	0	0	to	14	0	0
Tartar emetic	lb.	0	1	6	to	0	1	7
Theobromine	lb.	0	12	6	to	0	13	0
Tin perchloride, 33%	lb.	0	1	2	to	0	1	4
Perchloride, solid	lb.	0	1	5	to	0	1	7
Protochloride (tin crystals)	lb.	0	1	5	to	0	1	6
Zinc chloride 102° Tw.	ton	21	0	0	to	22	10	0
Chloride, solid, 96-98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	36	0	0	to	38	0	0
Dust, 90%	ton	45	0	0	to	47	10	0
Sulphate	ton	18	10	0	to	19	10	0

Coal Tar Intermediates, &c.

	Per	£	s.	d.	Per	£	s.	d.	
Alphanaphthol, crude	lb.	0	2	3	to	0	2	6	
Alphanaphthol, refined	lb.	0	3	0	to	0	3	3	
Alphanaphthylamine	lb.	0	2	0	to	0	2	1	
Aniline oil, drums extra	lb.	0	1	0	to	0	1	1	
Aniline salts	lb.	0	1	0	to	0	1	1	
Anthracene, 40-50%	unit	0	0	8	½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	3	6	to	0	3	9	
Benzidine, base	lb.	0	5	3	to	0	5	6	
Benzidine, sulphate	lb.	0	5	3	to	0	5	6	
Benzoin acid	lb.	0	1	9	to	0	2	0	
Benzoate of soda	lb.	0	1	7	½	to	0	1	9
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3	
Betanaphthol benzoyate	lb.	0	5	0	to	0	5	3	
Betanaphthol	lb.	0	1	4	to	0	1	4	
Betanaphthylamine, technical	lb.	0	5	0	to	0	5	3	
Croceine Acid, 100% basis	lb.	0	3	6	to	0	3	9	
Dichlorbenzol	lb.	0	9	0	to	0	9	0	
Diethylaniline	lb.	0	2	9	to	0	3	0	
Dinitrobenzol	lb.	0	1	3	to	0	1	4	
Dinitrochlorbenzol	lb.	0	0	11	to	0	1	0	
Dinitronaphthalene	lb.	0	1	4	to	0	1	5	
Dinitrotoluol	lb.	0	1	5	to	0	1	6	
Dinitrophenol	lb.	0	1	9	to	0	2	0	
Dimethylaniline	lb.	0	2	6	to	0	2	9	
Diphenylamine	lb.	0	4	3	to	0	4	6	
H-Acid	lb.	0	6	3	to	0	6	9	
Metaphenylenediamine	lb.	0	4	9	to	0	5	3	
Monochlorbenzol	lb.	0	0	10	to	0	1	0	
Metanilic Acid	lb.	0	6	0	to	0	6	6	
Metatoluylenediamine	lb.	0	4	6	to	0	4	9	
Monosulphonic Acid (2.7)	lb.	0	5	6	to	0	6	0	
Naphthionic acid, crude	lb.	0	3	0	to	0	3	3	
Naphthionate of Soda	lb.	0	3	0	to	0	3	3	
Naphthylamin-di-sulphonic-acid	lb.	0	4	0	to	0	4	3	
Neville Winther Acid	lb.	0	7	9	to	0	8	0	
Nitrobenzol	lb.	0	0	9	to	0	0	9	
Nitronaphthalene	lb.	0	1	3	to	0	1	4	
Nitrotoluol	lb.	0	1	0	to	0	1	2	
Orthoamidophenol, base	lb.	0	12	0	to	0	12	6	
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1	
Orthotoluol	lb.	0	0	8	to	0	0	10	
Para-amidophenol, base	lb.	0	9	0	to	0	9	6	
Para-amidophenol, hydrochlor	lb.	0	8	6	to	0	9	0	
Paradichlorbenzol	lb.	0	0	6	to	0	0	7	
Paranitraniline	lb.	0	3	6	to	0	3	9	
Paranitrophenol	lb.	0	2	3	to	0	2	6	
Paranitrotoluol	lb.	0	5	0	to	0	5	3	
Paraphenylenediamine, distilled	lb.	0	10	6	to	0	10	9	
Paratoluidine	lb.	0	6	0	to	0	6	6	
Phthalic anhydride	lb.	0	2	9	to	0	3	0	
Resorcin, technical	lb.	0	4	6	to	0	5	0	
Resorcin, pure	lb.	0	6	9	to	0	7	0	
Saol	lb.	0	2	0	to	0	2	3	
Sulphanilic acid, crude	lb.	0	1	0	to	0	1	1	
Tolidine, base	lb.	0	6	6	to	0	7	0	
Tolidine, mixture	lb.	0	2	6	to	0	2	9	

Industrial Welfare Society

The third annual Lecture Conference for Welfare Supervisors, organised by the Industrial Welfare Society, is being held at Balliol College, Oxford, from September 15 to 20. This year the Conference is open to both men and women, special arrangements having been made for the women delegates at Lady Margaret Hall. The session was opened on Friday evening by Mr. J. W. Pratt, M.P. The programme, which is of a very practical nature, will deal with such subjects as "Welfare under the Whitley Principle," "The Employment Department: Its Functions and Personnel," "Health, First Aid, Safety." On Sunday forenoon Mr. Frank Hodges, J.P., Secretary of the Miners' Federation of Great Britain, will give an address on "Health and Welfare in the Mining Industry." Dr. H. M. Vernon, of the Industrial Fatigue Research Board, will speak on "Record Keeping and Statistics." Other lectures will be "Canteens," by Mr. Arthur F. Agar, and "Superannuation and Pension Schemes," by Mr. J. H. Robertson. In addition there will be a series of short practical papers by supervisors, sectional meetings, and a special session for women.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

GLASGOW, SEPTEMBER 13, 1922.

BUSINESS still continues quiet, neither inquiries nor orders being at all plentiful.

There is nothing of importance to record, prices notwithstanding the quietness of the market, being fairly steady.

Industrial Chemicals

ACID ACETIC.—Glacial 98/100%. Quotations vary greatly. Business done at £57 to £62 per ton. 80% Technical, about £39 to £40 per ton. 80% Pure, £44 to £45 per ton. Offered at £34 per ton, f.o.b. Hamburg.

ACID BORACIC.—Crystal or Granulated, £60 per ton. Powdered, £62 per ton.

ACID CITRIC.—Quoted at 2s. 3d. per lb., less 5%.

ACID HYDROCHLORIC.—Maker's price unchanged—6s. 6d. per carboy, ex works.

ACID NITRIC, 80°.—Offered at £27 per ton.

ACID OXALIC.—Quoted 7½d. per lb. Moderate inquiry.

ACID SULPHURIC.—Fair export inquiry. 144°, £4 per ton. 168°, £7 5s. per ton. Dearnsicated quality £1 per ton extra.

ACID TARTARIC.—On offer at 1s. 2½d. per lb.

ALUM, CHROME.—Continental offers of £30 per ton, c.i.f.

ALUM, LUMP POTASH.—Spot lots offered at £15 per ton, ex store.

AMMONIA ANHYDROUS.—In little request. 1s. 8d. to 1s. 9d. per lb., ex works.

AMMONIA CARBONATE.—Price unchanged. Lump, 4d. per lb. Powder, 4½d. per lb., delivered.

AMMONIA MURIATE.—Galvanizers' Grey, £35 to £36 per ton.

Fine white crystals, 98/100%, quoted £24, c.i.f. U.K.

AMMONIA SULPHATE.—25½%, £14 15s. 25¾%, £15 18s. per ton, ex works, September/October delivery.

ARSENIC, WHITE POWDERED.—In moderate request. £45 per ton, ex quay.

BARIUM CHLORIDE.—Continental material about £21 per ton, c.i.f. U.K.

BARIUM THIOSULPHATE.—Supplies are offered at 1s. per lb., carriage paid.

BARYTES.—Finest white, English, unchanged, at £5 5s. per ton, ex works.

BLEACHING POWDER.—Price unchanged. £12 15s. per ton, ex station.

BORAX.—Crystal or granulated, £29 per ton; powdered, £30 per ton.

CALCIUM CHLORIDE.—English made £6 per ton, ex quay. Continental offered at £4 10s., c.i.f. U.K.

CASTOR OIL (FIRST PRESSURE).—Offered at £51 per ton, ex mills.

COPPER SULPHATE.—Quoted £26 per ton, ex quay.

COPPERAS, GREEN.—Unchanged, at about £3 15s. to £4 per ton, ex works.

FORMALDEHYDE, 40%.—Spot parcels on offer at £68 per ton. On offer for prompt shipment from Canada at £60 per ton, c.i.f.

GLAUBER SALTS.—Fine commercial crystals, £5 per ton, ex store.

LEAD.—Red, £37 15s. per ton; white, £49 15s. per ton, delivered in minimum 5-ton lots. Continental offers of £35 per ton for white lead; £33 10s. for red lead, c.i.f. U.K.

MAGNESITE, GROUND CALCINED.—Price £9 to £12 per ton, according to quality. Finest Euboean offered at £9, c.i.f. U.K.

MAGNESIUM CHLORIDE.—Moderate inquiry. £6 to £6 10s. ex store, spot delivery. Offered at £4 15s., c.i.f. U.K.

MAGNESIUM SULPHATE (EPSOM SALTS).—Commercial, £7 5s.; B.P., £9 10s. per ton.

NAPHTHALINE.—Cheap Continental offers of £14 per ton, c.i.f., for white crystals.

POTASSIUM BICHROMATE.—English make unchanged. 6½d. per lb., delivered.

POTASSIUM CARBONATE, 90/92%.—Offered at £28 10s. per ton, ex store; 96/98%, about £32 10s. per ton, ex store.

POTASSIUM CAUSTIC, 88/92%.—Spot lots £3c per ton, ex store. Offered at £27 per ton, c.i.f. U.K.

POTASSIUM CHLORATE, 98/100%.—Quoted 4½d. per lb., ex store.

POTASSIUM NITRATE (SALTSPETRE).—Remains unchanged at about £33 per ton.

POTASSIUM PERMANGANATE.—Commercial crystals, 8½d. to 9d. per lb.

PYRITES, SPANISH FINES.—Offered at 12s. per ton, f.o.b., on basis 48% sulphur.

SODIUM BICARBONATE.—Refined recrystallised, £10 10s. per ton, ex quay or station; M.W. quality, £1 per ton less.

SODIUM BICHROMATE.—English makers' price unchanged, at 5d. per lb.

SODIUM CARBONATE (SODA CRYSTALS).—£5 10s. to £5 15s. per ton, ex quay or station.

SODIUM CARBONATE (ALKALI 58%).—Spot lots £9 1s. 6d. per ton, ex quay or station.

SODIUM CAUSTIC.—Prices unchanged. 76/77%, £23 5s.; 70/72%, £21 5s.; 60% broken, £24; powdered, 98/99%, £26 15s. to £27 15s.; bottoms, £13 per ton ex station.

SODIUM HYPOSULPHITE.—Pea crystals quoted, £16 10s., f.o.b., for export; commercial about £12/£13, ex store.

SODIUM NITRATE.—Quoted, £12 10s., f.o.b., prompt delivery.

SODIUM SILICATE, 140°.—Moderate inquiry for export; £11 per ton, f.o.b.

SODIUM SULPHATE (SALTCAKE 95%).—Price for home consumption, £4 per ton on contract; higher prices quoted for export.

SODIUM SULPHIDE, 60/62% CONC.—Offered at £16 per ton, c.i.f. U.K.

SULPHUR.—Government surplus stocks of Sicilian thirds available at £4 5s. to £4 15s. per ton, f.o.r.; flowers, £13; roll, £12; rock, £11; ground, £11 per ton, ex store.

TIN CRYSTALS.—Price unchanged. 1s. ad. per lb.

WAX, NO. 1 JAPAN.—Offered at 8½s. per cwt. ex store.

ZINC CHLORIDE.—Ordinary crystals offered at £16 per ton.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ANTHRANILIC ACID.—Home inquiry. Price quoted, 10s. per lb., 100% basis.

BETA NAPHTHOL.—Prices are slightly lower, and supplies can be obtained at 1s. 1½d. to 1s. 2d. per lb.

DINITROBENZOL.—Export inquiry. Price 1s. 3d. per lb., f.o.b.

DIPHENYLAMINE.—Home inquiry. Price quoted, 4s. 3d. per lb., delivered.

"H" ACID.—Home inquiry. Price quoted, 6s. 6d. per lb., 100% basis.

PARA AMIDO PHENOL HYDROCHLORIDE.—Home inquiry. Price 8s. 8d. per lb., 100% basis.

PHthalic Anhydride.—Home inquiry. 2s. 6d. to 2s. 9d. per lb. according to quantity.

Salicylic Acid, B.P.—Market inclined to harden. Price 1s. 5d. to 1s. 6d. per lb., delivered.

British Sugar Beet Schemes

In accordance with the working arrangements which have been entered into with the view to the future amalgamation of the Kelham and Cantley sugar beet schemes, it has been arranged for the sugar beet crops of the Kelham growers to be worked at the Cantley beet sugar factory this year. By dealing with the total acreage of beet now being grown in this country (upwards of 8,000 acres) at one factory so that it can work at its full capacity, it is hoped to secure the lowest economic cost of sugar production for future guidance. In the meantime proposals for extending and improving the Kelham beet sugar factory are under consideration, with the same object in view for future seasons.

The Manchester Chemical Market

FROM OUR OWN CORRESPONDENT.

Manchester, September 14.

THE general undertone of the chemical trade here may be described as quietly healthy. The chief consuming industries—textiles and iron and steel—are picking up, and the position is reflected in a steadier demand for heavy chemicals for home consumption. Prices show no marked sign of weakening, sellers, on the whole, standing firm.

Except in regard to one or two products—caustic soda, bleaching powder and alkali may be cited as examples—foreign business is still restricted. The greater proportion of the overseas trade passing is on Colonial account, a number of parcels having been sold here for shipment. Continental inquiry is necessarily curtailed, and what little business is being done is not, for obvious reasons, easy to put through.

Activity in "chemicals" has been one of the features of business on the Manchester Stock Exchange during the last few days. Brunner-Mond, Salt Union, Borax Consolidated and United Alkali have all been supported during the week at firmer prices.

Heavy Chemicals

Caustic soda is in fairly active inquiry both for home consumption and export, prices for the former ranging from £20 5s. to £23 5s., according to quality and terms of delivery. Bleaching powder is also steady, and in moderate demand. Soda bicarbonate has been a quiet section at £10 5s. to £10 10s. per ton. Soda crystals have also been rather quiet, but the price has been maintained at about £5 12s. 6d. delivered. Saltcake has attracted both home and foreign buyers, and is a strong feature, fairly good quantities having been disposed of at from £4 5s. to £4 10s. per ton. Hyposulphite of soda is only in limited demand: photographic quality is quoted at £18 and commercial at £12 per ton. Acetate of soda is quiet at £23 10s. to £24 10s. Nitrate of soda, 100 per cent. basis, is offered at £28 10s. per ton. Sodium sulphide, 60-65 per cent., Continental makes, is quoted at as low as £16 10s. c.i.f., and crystals at £11, but there has not been a great deal of business. A better demand has been experienced for Glauber salts.

Among potash products, caustic has met with an improved inquiry, although prices are slightly easier at about £28 10s. per ton for 88-90 per cent. strength. Carbonate also finds a better market at £29 10s. for 96-98 per cent. material. Chlorate is quoted at 4½d. per lb., and meets with a moderate demand. Yellow prussiate is firm at about 1s. 6d. per lb., and supplies either for spot or forward delivery are not excessive.

There is not a great deal being done in sulphate of copper, although the price is maintained at £26 to £27 per ton in casks. With short supplies and a fair demand, the position of arsenic is very firm, and white powdered, Cornish makes, is quoted at from £44 10s. to £46 per ton. Commercial Epsom salts bring £6 to £6 5s. per ton, but consumption is not particularly strong. Chloride of barium is quiet, and at £19 10s. per ton the value is a shade easier. Grey acetate of lime is scarce at £14 10s., with brown quoted at £8 10s. Litharge is readily taken up, supplies bringing up to £39 per ton, according to brand. Acetate of lead, white, is steady at £38, and brown, £35. Zinc chloride is quiet, while Continental supplies of sulphate are available at around £10 10s. per ton.

Acids and Tar Products

Tartaric and citric acids are rather inactive, and quotations are 1s. 3d. to 1s. 4d., and 2s. 2d. per lb. respectively. Oxalic acid is dull at 7½d. A fair amount of business is passing in acetic acid, and prices are distinctly firm; 98 per cent. glacial is about £67 10s., and 80 per cent. (pure) £45.

Coal-tar products, on the whole, are an exceptionally strong market, and there is active buying for home users and for shipment. As high as £4 5s. per ton has been mentioned here as the f.o.b. price for pitch. Carbolic acid crystals are far from plentiful, considering the demand for the product, largely for shipment to the United States, and 6½d. to 6¾d. per lb. is being asked. Solvent naphtha is one of the quietest lines in this section, and supplies are offered at 1s. 10d. to 2s. per gallon. Flake naphthalene is firm at about £17 per ton.

British Cellulose Co.

Formation of £500,000 Holding Company

ANOTHER move in the effort to improve the position of the British Cellulose and Chemical Manufacturing Company, with its £6,500,000 of issued capital, is reported. According to published statements, an issue of £500,000 seven per cent. participating first mortgage debenture stock in the Cellulose Holdings and Investment Company will be made at par in the course of the next few days. This company has been formed to provide the British Cellulose and Chemical Manufacturing Company with further funds. The new company has subscribed at par for £500,000, the entire amount authorised, of eight per cent. first mortgage debenture stock in the British Cellulose Company. This money, it is believed, will be sufficient for the Cellulose Company to pay off its outstanding bankers' loans, to provide new plant increasing the output of silk from one to three tons a day, and to leave a satisfactory margin for working capital.

To put the Cellulose Company in a position to secure this fresh financial support several important transactions have been necessary. The Government has agreed to hand over to the Holding Company 750,000 seven and a half per cent. cumulative participating preference shares of £1 each in the British Cellulose Company. The Holding Company has purchased for a sum of £200,000 the generating station belonging to the British Cellulose Company, at Spondon, near Derby. This purchase is being satisfied by the surrender by the Holding Company of £200,000 of the eight per cent. first mortgage debentures out of the total of £500,000. This generating station has in turn been resold by the Holding Company to the Midland Counties Electric Supply Company for £100,000 in cash and £25,000 fully paid ordinary shares of £1 each in the Midland Counties Electric Supply Company. On these shares a dividend of 4 per cent. was paid for 1921.

It is stated that the position of the British Cellulose Company has recently improved. Sales of silk for the year to end of June, 1922, were seven times those of the corresponding period of 1921. A small profit is now for the first time being made.

The Nitrate Market

Increasing Costs of Synthetic Products

In their latest circular, Aikman (London), Ltd., state that since August 22 the arrivals amount to about 14,000 tons, and about 15,000 tons are due during the next fortnight. The market has been active throughout the fortnight, and dealers in close touch with consuming markets have continued to lay in stocks freely for next season's delivery. The Producers' Association have sold a further 115,000 tons, mostly for early shipment, making their total sales to date for the current nitrate year about 800,000 tons, of which about half has been sold for shipment to the United States and other countries outside Europe. Sales would have been on a materially larger scale for May-June 1923 delivery had not the Producers' Association withdrawn from selling these positions after the disposal of only 35,000 tons, no doubt with the intention of later on fixing a higher scale of prices for these positions.

A fair business has been reported in steamer parcels September-October shipment to Europe at 11s. 8d. to 12s. 1½d. per cwt. c.i.f. according to destination, and an early August sailing cargo was sold at 11s. 9d. per cwt. c.i.f. Closing values are about 11s. 8d. to 11s. 10d. September-October, 12s. November, and 12s. 2d. to 12s. 4d. per cwt. c.i.f. December-January shipment basis Bordeaux-Hamburg range, with extra freight for special options.

Increasing costs and reduced production of synthetic nitrogen products in Germany have resulted in active negotiations in Berlin for the sale of Chilean nitrate to Germany for next season, and an announcement has now been made that the German Government have sanctioned the import of 200,000 tons of Chilean nitrate up to May 31, 1923, the sale of which to be controlled by the Hamburg Nitrate of Soda Importers' Corporation.

The German Government have, furthermore, consented to the free import of unlimited quantities for consignment, which must not, however, be sold until after the disposal of the first 200,000 tons.

Nobel Industries, Ltd.

Policy of Consolidation Still Proceeding

THE directors of Nobel Industries, Ltd., in their report for 1921, state that the receipts brought to account in respect of the year's operations comprise the dividends received from the constituent and associated companies out of profits for 1921. The profit for the year (after allowing for income tax deducted from dividends by the constituent and associated companies) amounted to £809,242, and after providing £167,693 interest, less tax, on the 8 per cent. seven-year secured notes, the balance at credit of profit and loss is £641,549; deduct provision to write off one-seventh of the cost of note issue, £37,285, leaving £604,264, which, with the amount brought in from the previous year, £757,498, amounts to £1,361,762.

A dividend was paid on the preference shares on August 1, 1921, at the rate of 6 per cent. per annum, less tax, for the half-year ended June 30, 1921, amounting (with provision for further surrenders of shares of constituent companies) to £134,471, leaving £1,227,291, which the directors recommend be appropriated as follows: Preference share dividend at the rate of 6 per cent. per annum, less tax, for the half-year ended December 31, 1921 (paid February 1, 1922), including provision for shares subsequently surrendered, £134,772; ordinary share dividend at the rate of 5 per cent., less tax, for the year 1921, including provision for shares subsequently surrendered (paid July 1, 1922), £279,170, leaving a balance now available of £813,349.

Fluctuations in Securities

While the market value of quoted industrial securities held by the company or its constituents as at December 31, 1921, stood materially below their cost to Nobel Industries, Ltd., it has since been steadily recovering, and, with improved conditions the directors anticipate a continuance of this movement. In order to be fully protected, however, against such temporary fluctuations in the market values of the company's permanent industrial interests, the directors have decided to recommend the building up of a special investment reserve account and the allocation thereto, out of the present amount available, of £350,000. This appropriation will leave £463,349 to be carried forward.

Many of the companies' interests suffered severely during 1921 from the prevailing depression in trade, and the stoppage in the coal industry inflicted heavy loss upon the explosives business during the summer. The directors feel, therefore, that the results for the year as a whole give considerable ground for satisfaction, and with a gradual, but perceptible, improvement in trade prospects now in progress, they have continued confidence in the future of the company.

The company's policy of consolidation and co-ordination, to which reference was made last year, is still proceeding. It has involved putting into voluntary liquidation the various companies affected—e.g., National Explosives Co., Ltd., Cotton Powder Co., Ltd., Kynoch-Arklow, Ltd., British Explosives Syndicate, Ltd., the Chilworth Gunpowder Co., Ltd., and the Birmingham Metal and Munitions Co., Ltd. That part of the proceeds from realisations not yet formally distributed has been lent to the company and employed in connection with the additional interests acquired since its formation.

The directors report with deep regret the loss sustained by the company during the year in the death of Sir George Smith. The directors also regret the retirement from the board of Lord Ribblesdale and Mr. W. A. Tennant, the former in consequence of ill-health and the latter by reason of his curtailment of business activities. Two of the vacancies thus created have been filled by the appointment of the late Sir George Smith's son, Colonel G. E. Stanley Smith, D.S.O., and Mr. H. Donald Hope, who retire in accordance with Article 89, and are recommended for re-election, together with Sir Ralph William Anstruther, Mr. M. F. Armstrong, Colonel J. W. Weston, M.P., and Mr. Oliver Williams, who also retire in accordance with the provisions of Article 108.

The ordinary general meeting will be held at Winchester House on September 22, at 12.30.

Company News

DOMINION TAR AND CHEMICAL CO.—Final dividend of 2½ per cent., tax free, making 5 per cent., tax free, for year, and bonus of 2½ per cent., tax free.

UNITED TURKEY RED CO.—The company announce that they do not feel justified in declaring an interim dividend on the ordinary shares. Accounts for 1921 showed a loss of £199,700, reduced to £146,405 by the amount brought in. Reserve of £200,000 was transferred to profit and loss; preference dividends were paid and £11,531 carried forward.

BROKEN HILL SOUTH.—A message from Melbourne states that the report shows a year's net profits of £235,000, after providing £68,000 for taxation and depreciation. The largest proportion of profit resulted from the treatment of dump slime accumulations. The result is considered highly satisfactory, considering that only one shift was worked in the first period and two shifts in the second period of the year, as compared with three shifts before the war.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. NO.
Switzerland ..	Caustic potash, sulphate of soda, potassium silicate, formic acid, olein, olein soap, etc.	283
Egypt ..	Oils, paints and varnishes	9008

Tariff Changes

DOMINICA.—The importation is prohibited, except under licence, of kerosene oil of 110° fire test and under.

RUSSIA.—New regulations regarding the import and export of goods were published in the *Board of Trade Journal*, of September 7 (p. 275).

POLAND.—A revised list of export prohibitions affects potassium salts, metallic ores and minerals, mineral oil, sperm oil, and cylinder oil.

ITALY.—A recent Royal Decree provides for the levying of increased duties on goods imported into Italy from countries which differentiate against Italian goods.

GERMANY.—The surtax leviable when the "gold" duties of the German Customs Tariff are paid in paper currency was increased to 28,900 per cent. for the period September 6 to 12. The surtax for the period up to September 5 was 21,900 per cent. Particulars of new increases in export duties are obtainable on written or personal application to the Tariff Section of the Department of Overseas Trade, 35, Old Queen Street, London.

A Secret Manure Process

WHEN Richard Harrhy, of Bridgend, appeared at the Cardiff Bankruptcy Court on Wednesday, September 6, for his public examination on a deficiency of £128 11s. 2d., he told the Official Receiver that his failure was due principally to lack of capital in connection with the manufacture and marketing of a special manure which he had invented, and to the slump in sales caused by the coal strike. The debtor said he was prepared to disclose to the Official Receiver the secret process for producing the manure, which was known only to himself, and had not been put into writing or patented. He attended the mills and himself added the chemicals as the lime was ground. At one time he had 2,000 customers, but after the end of the war the allotment boom slackened off and his customers fell away. The examination was adjourned.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the " Registry of County Court Judgments " does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

BARRITT, E. C., 459, Harrow Road, W., chemist. £11 7s. 7d. July 25.

BURLINGTON INDUSTRIAL LABORATORIES, LTD., Onslow Mills, Yiewsley, manufacturing chemists. £13 18s. 7d. July 18.

COE, W. W., jun., of Coes Chemical Products, 24-26, Holborn, E.C., manufacturing chemist. £36 4s. 6d. August 3.

HEX, John Robinson, 108, Euston Road, N.W., chemist. £10 2s. 6d. July 31.

LEWIS, Jack Morton, 1, Holmdale Mansions, Holmdale Road, West Hampstead, analytical chemist (and another). £30 6s. 6d. July 25.

LLEWELLYN, Willie, Dunraven Street, Tonypandy, chemist. £14 18s. 1d. August 1.

MAYOUS, LTD., 170, Alum Rock Road, Saltley, Birmingham, chemists. £13 2s. 11d. July 27.

PHILLIPPS, Elsie J. (Miss), 668, Fishponds Road, Bristol chemist. £33 7s. 3d. July 20.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

HOWARD'S DRUG STORES, LTD., London, S.E.—Registered September 1, £200 first debenture, to E. Howard, 184, Old Kent Road, S.E., chemist; general charge.

NATIONAL BY-PRODUCTS, LTD., London, W.C.—Registered September 4, £5,000 debentures; charged on freehold property at Grateley, and company's interest in lease of premises at Aldershot, also general charge.

RENIER (M.) AND CO., LTD., London, W., manufacturing chemists.—Registered September 4, £750 first debenture, to B. J. Wilden-Hart, 44, Clifton Gardens, W., professor of economics; general charge.

SHARP (J. B. AND W. R.), LTD., Edenfield, chemical manufacturers.—Registered September 2, £12,500 debentures (filed under section 93 (3) of the Companies (Consolidation) Act 1908), present issue £8,000; general charge. *£34,000. September 16, 1921.

Satisfactions

BELL (JOHN) AND CROYDEN, LTD., London, W. chemists.—Satisfaction registered September 1, all money etc., registered October 24, 1921.

DINNEFORD AND CO., LTD., London, W., manufacturing chemists.—Satisfaction registered September 1, £12,500, registered February 3 and May 25, 1921.

GRAYSON (CHEMISTS), LTD., London, W.C.—Satisfaction registered September 4, £600, part of amount registered June 28, 1922.

Partnership Dissolved

TONY PRODUCTS CO. (Harold Edwin PERKS, Francis William COLE, and Hyman COHEN), dye and liquid cement merchants, Spencer House, South Place, Finsbury Pavement, E.C., by mutual consent as from July 10, 1922. Debts received and paid by H. Cohen.

London Gazette

Notice of Intended Dividend

CHEETHAM, Reginald Spencer, 48, Bridge Street, Peterborough, Northants, druggist. Last day for receiving proofs, September 22. Trustee, P. S. Booth, 28, Kimberley House, Holborn Viaduct, London.

New Companies Registered

ARCHER'S MANUFACTURING CO., LTD., Church Wharf, Chiswick, London, W.4. Manufacturing chemists, etc. Nominal capital, £4,000 in £1 shares.

JAS. E. BLAKEMORE, LTD., 46, Bolton Street, Bury. Toilet requisites and perfume manufacturers and merchants. Nominal capital, £1,000 in £1 shares.

BLESCO, LTD., Melrose Hill Lane, Southampton. Manufacturers of polish and enamel of all kinds, etc. Nominal capital, £100 in £1 shares.

BROTHERS CHEMICAL CO. (1922), LTD. Manufacturers and importers and exporters of and dealers in carbonate and bi-carbonate of ammonia, etc. Nominal capital, £6,300 in 6,000 10 per cent. cumulative preference shares of £1 each and 6,000 ordinary shares of 1s. each. A subscriber: W. Brothers, Meadow House, near Whaley Bridge.

F. R. BUCKLEY AND CO., LTD., Salisbury House, London E.C.2. Glass merchants and manufacturers, manufacturers of and dealers in druggists' sundries, etc. Nominal capital, £25,000 in £1 shares.

C. R. L., LTD., 604, Fulham Road, London, S.W.6. Engineers, chemical, metallurgical, pathological and bacteriological researchers, manufacturing chemists, etc. Capital, £3,150 in 3,000 "A" ordinary shares of £1 each and 3,000 "B" ordinary shares of 1s. each.

INVERESK PAPER CO. (1922), LTD., Inveresk Mills, Musselburgh, N.B. Manufacturers of paper and pulp of all kinds, and articles made of or from paper, pulp or esparto, paper mill owners, etc. Nominal capital, £250,000 in £1 shares.

JAPANOL ENAMEL CO. (limited partnership), Culford Works, Kingsbury Road, Kingsbury. Manufacturers of and dealers in enamels, paints, varnishes, etc.

SPITANI POLISH CO., LTD. (private company). Soap manufacturers, chemists, druggists, etc. Capital, £10,000 in £10 shares. A director: T. Hall, Leechmere, Ryhope, Sunderland.

THOS. ALEXANDER LOWE AND CO., LTD., 19, Castle Street, Liverpool. Fertiliser and artificial manure merchants, etc. Nominal capital, £6,000 in £1 shares.

PACIFIC SETTLEMENT CO., LTD., 19, Baxter Gate, Loughborough, Leicester. Dealers in copra and other natural and artificial manures, etc. Nominal capital, £4,000 in £1 shares.

"QUEEN BEE" POLISH, LTD., The Old Vicarage, George Street, Llandilo. Manufacturers of and dealers in polish, wax, oils, and other polish ingredients, etc. Nominal capital, £200 in £5 shares.

W. J. SUTCLIFFE (SOUTHPORT), LTD., 70, Eastbourne Road, Birkdale. Chemical manufacturers, etc. Nominal capital, £2,000 in £1 shares.

HOWARD TOOLE AND CO., LTD., 15, Earl Street, Liverpool. Soap manufacturers, perfumers, glycerin distillers, oil refiners, alkali merchants, chemical manufacturers, etc. Nominal capital, £2,500 in £1 shares.

A New Mixing Machine

We learn from Robert Boby, Ltd., of Bury St. Edmunds, that they are manufacturing a machine for the rapid mixing or blending of liquid matter, such as emulsions, essences, syrups, oils, extracts, milk foods, molasses, varnish, colours, etc. The container, which is made of oak, is fitted with a set of propellers. These can be adjusted to revolve at any desired speed, and the blades are set in such a way as to deflect the material from the ends towards the centre, thereby intensifying the mixing process. The machine is made in a variety of sizes, holding from 4 to 20 gallons or more, and deals with separate fillings and emptyings, or continuous flow and exit can be arranged with the aid of suitable valve connections.

